SCIENTIFIC AMERICAN

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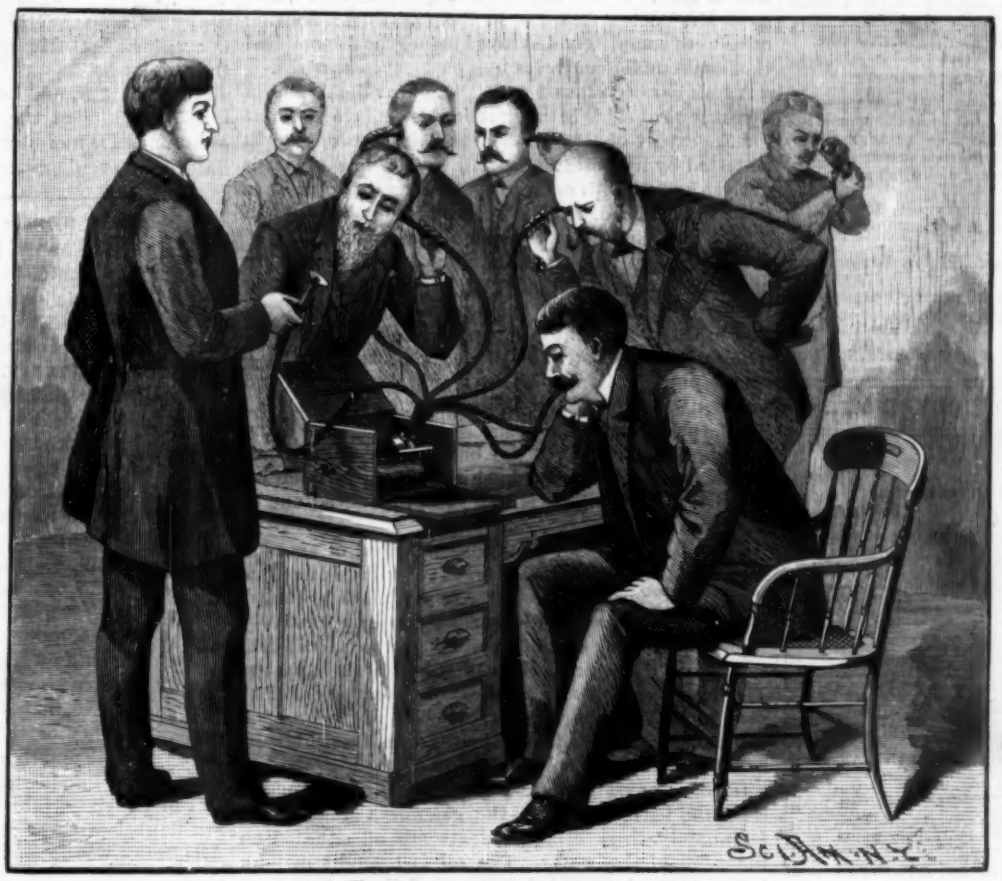
THE NEW PHONOGRAPH.

Ten years ago a young man came into the office of the SCIENTIFIC AMERICAN, and placed before the editors a small, very simple machine about which very few preliminary remarks were offered. Our visitor without any ceremony whatever turned the crank, and to the astonishment of all present the machine said: "Good morning. How do you do? How do you like the phonograph?" The machine thus spoke for itself, and made known the fact that it was the phonograph, an instrument about which much was said and written, although little was known.

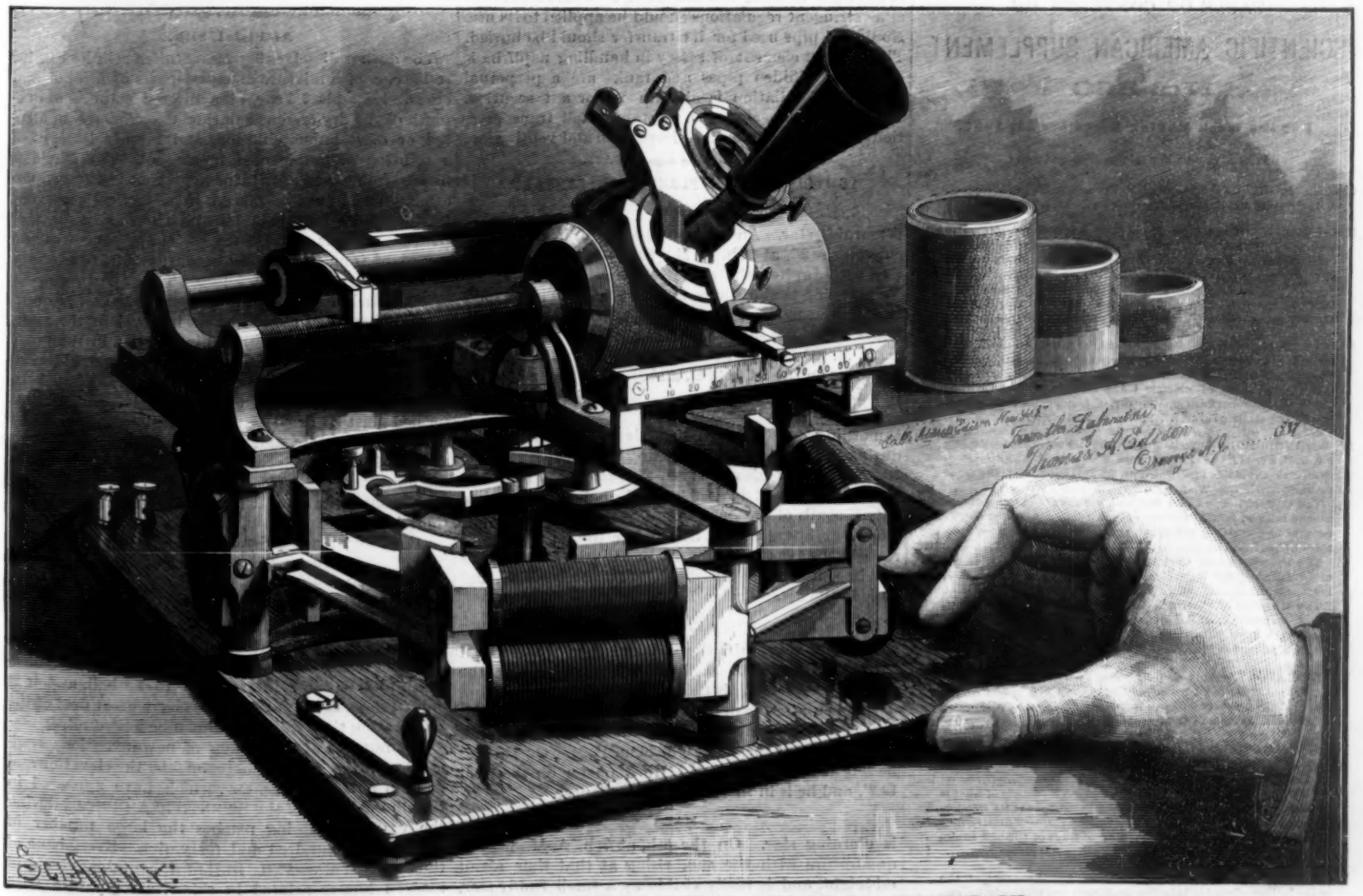
It was the latest invention of Edison, and the editors and employes of the SCIENTIFIC AMERICAN formed the first public audience to which it addressed itself. The young man was Mr. Thomas A. Edison, even then a well known and successful inventor. The invention was novel, original, and apparently destined to find immediate application to hundreds of uses. Every one wanted to hear the wonderful talking machine, and at once a modified form of the original phonograph was brought out and shown everywhere, amusing thousands upon thousands; but it did not by any means fulfill the requirements of the inventor. It was scarcely more than a scientific curiosity or an amusing toy. Edison, however, recognized the fact that it contained the elements of a successful talking machine, and thoroughly believed it was destined to become far more useful than curious or amusing. He contended that it would be a faithful stenographer, reproducing not only the words of the speaker, but the quality and inflections of his voice; and that letters instead of being written would be talked. He believed that the words of great statesmen and divines would be handed down to future generations; that the voices of the world's prima donnas would be stored and preserved, so that, long after their decease, their songs could be heard. These and many other things were expected of the phonograph. It was, however, doomed to a period of silence. It remained a toy and nothing more until a few months since, when it was made known to the public that the ideal phonograph had been constructed; that it was unmistakably a good talker; and that the machine which most people believed to have reached its growth had after all been refined and improved until it was capable of faithfully reproducing every word, syllable, vowel, consonant, aspirate, and sounds of every kind.

During the dormancy of the phonograph its inventor secured both world-wide fame and a colossal fortune by means of his electric light and

(*Continued on p. 422.*)



PHONOGRAPH WITH MULTIPLE EARPIECE.



THE NEW TALKING MACHINE, EDISON'S WONDERFUL PHONOGRAPH.

Scientific American.

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NEW YORK, SATURDAY, DECEMBER 31, 1887.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 626,

For the Week Ending December 31, 1887.

Price 10 cents. For sale by all newsdealers.

NAPHTHA EXPLOSIONS IN ROCHESTER AND JERSEY CITY.

A very serious explosion, due to an escape of naphtha, took place in Rochester, N. Y., on December 21. The Municipal Gas Light Company of that city uses one of the modern gas making processes, in which naphtha is employed for enriching the gas. The gas works receive large quantities of naphtha from the Vacuum Oil Works, and the two establishments are connected by a pipe line, part of which is placed in the bed of the canal. Fourteen thousand gallons of the inflammable fluid had been pumped into the line to be carried by it to the works. One or more leaks existed in the pipe line, and, in consequence, a quantity of the naphtha escaped and found its way into the sewers. At 3:25 P. M. it caught fire and exploded near John H. Poole's mill. The roof was blown off the mill and the street was torn up at intervals for a distance of half a mile. Other explosions rapidly followed, and soon Mr. Poole's mill was in flames. Three flouring mills were completely destroyed before the firemen had the flames under control at half past eleven at night.

A leak has been found in the pipes near the Atkinson Street sewer. This is thought insufficient to account for the extent of the disaster, and the whole line will be tested by hydrostatic pressure. The loss of life is not yet known with certainty, but several people have probably perished. The sewers are badly damaged in places, and windows were broken everywhere.

Immediately following the news of this occurrence comes the tidings of another similar accident, though, fortunately, of far less extent. In the office of the Jersey City Gas Light Company, in Jersey City, N. J., a naphtha leak existed in the cellar. The heat of the steam pipes, it is supposed, vaporized the fluid, and about noontime on December 22 two explosions followed each other in quick succession, the second being the worse. The front of the building was blown out, but the occupants escaped with more or less serious injuries. One of them is not yet pronounced out of danger.

These two accidents emphasize the need of extreme care in dealing with naphtha. It is more dangerous than gas, because when a leak occurs it takes far longer for the last traces to disappear. Its comparatively stable nature makes it a fearful adjunct to a conflagration, as it burns and when mixed with air explodes. The first explosion only disposes of a part of the danger; some will almost always be left to prolong the trouble. Water acts ineffectually in extinguishing it, as it floats and burns upon the surface.

In this city vast quantities are used, probably over a thousand barrels a day in the gas works alone. But, fortunately, these establishments are all situated on the edge of the water. The oil is brought in tank barges to the dock and then pumped through a short line into tanks, whence it is taken to the works. Yet, in the light of what has occurred, it would seem that more stringent regulations should be applied to its use. No line of pipe used for its transfer should be buried. The greatest element of safety in handling naphtha is exposure. Hidden pipes and tanks are a perpetual menace. Ventilation is also an important security. Everything connected with its storage and transportation should be open both to inspection and ventilation.

POSITION OF THE PLANETS IN JANUARY.

VENUS

is morning star. An interesting event in her course occurs on the 2d, at 11 h. A. M. She is then in conjunction with Jupiter, the planets being only 1° 51′ apart, Venus being that distance farther north. The planets rise on the morning of the conjunction about three hours before the sun. Venus rises on the 1st at 3 h. 54 m. A. M. On the 31st she rises at 4 h. 47 m. A. M. Her diameter on the 1st is 18·8″, and she is in the constellation Libra.

JUPITER

is morning star. He signalizes his progress in the sky during the month by his meeting with Venus on the 2d. He makes also a close conjunction with Beta Scorpii on the 24th, at 6 h. P. M., being at that time only 8′ south of the star. At the close of the month he rises four hours and a half before the sun. Jupiter rises on the 1st at 4 h. 4 m. A. M. On the 31st he rises at 2 h. 30 m. A. M. His diameter on the 1st is 31″, and he is in the constellation Libra.

SATURN

is morning star until the 23d, and then evening star. On the 23d, at 9 h. A. M., he is in opposition with the sun. He is then at his nearest point to the earth, and is visible under the most favorable conditions, rising at sunset and continuing above the horizon all night. Saturn rises on the 1st at 6 h. 26 m. P. M. On the 31st he sets at 6 h. 49 m. A. M. His diameter on the 1st is 19·2″, and he is in the constellation Cancer.

MARS

is morning star. On the 5th, at 7 h. A. M., he is in quadrature with the sun, rising at that time about midnight, and is easily visible as a small ruddy star, northwest of Spica. On the 9th, at 2 h. P. M., Mars is in conjunction with Uranus, being 1° 10′ north. Mars rises on the 1st at 0 h. 15 m. A. M. He rises on the 31st at 11 h. 13 m. P. M. His diameter on the 1st is 7·4″, and he is in the constellation Virgo.

MERCURY

is morning star until the 18th, and then evening star. He is in superior conjunction with the sun on the 18th, at 3 h. P. M., passing beyond the sun, and changing from his western to his eastern side. Mercury rises on the 1st at 6 h. 53 m. A. M. On the 31st he sets at 5 h. 48 m. P. M. His diameter on the 1st is 4·8″, and he is in the constellation Sagittarius.

URANUS

is morning star. On the 7th, at 7 h. P. M., he is in quadrature with the sun. Uranus rises on the 1st at 0 h. 37 m. A. M. On the 31st he rises at 10 h. 35 m. P. M. His diameter is 3·6″, and he is in the constellation Virgo.

NEPTUNE

is evening star. He sets on the 1st at 4 h. 4 m. A. M. On the 31st he sets at 2 h. 4 m. A. M. His diameter on the 1st is 2·6″, and he is in the constellation Taurus.

At the close of the month, Mars, Uranus, Jupiter, and Venus are morning stars. Neptune, Mercury, and Saturn are evening stars.

Saved by the Scientific American.

Mr. J. J. Stranahan is the editor of the *Exponent*, a bright paper published at Chagrin Falls, Ohio. In a recent issue of his journal he gives the following:

"Those wishing to be well up in scientific and mechanical matters cannot afford to be without the SCIENTIFIC AMERICAN. It has been a constant visitor at our sanctum for fourteen years, and the other half of our family says that it is nip and tuck between the Bible and the SCIENTIFIC AMERICAN so far as we are concerned. We, however, have a double interest in the SCIENTIFIC AMERICAN, for, but for it, a new man would be behind the editorial quill of the *Exponent*. When we came near crossing the dark river, when taken by cramps while swimming across Mark Neice's pond in Newbury last summer, the first thought that entered our mind in that awful moment was an article which we had read about two weeks before in the SCIENTIFIC AMERICAN, on how good swimmers are drowned by becoming frightened, when by coolness and deliberation they could save their lives. Although ten rods from shore, in twenty or thirty feet of water, with severe cramps in neck and thigh, we swam to shore, and spoiled a nice funeral and cheated some other fellow out of a seat in the sixty-eighth general assembly. And there are doubtless those who wish that the SCIENTIFIC AMERICAN was in Hades before that article was published."

Mr. Stranahan further states that the facts above given are true to the letter.

Artificial Silk.

The author dissolves 3 grms. of nitro-cellulose in 100 to 150 c. c. of a mixture of equal parts of alcohol and ether. He adds 2·5 c. c. of a filtered solution at one-tenth of the dry ferrous chloride of commerce in alcohol, or of stannous chloride, and further 1·5 c. c. of a solution of tannic acid in alcohol. The whole is filtered in a closed apparatus to prevent loss by evaporation. The liquid is placed in a vertical reservoir, having at its bottom a blowpipe nozzle of glass or platinum. This pipe forms an acute cone with an orifice of from 0·10 to 0·20 mm., the thickness of the margin not exceeding 0·1 mm. This aperture opens into a vessel of water acidulated with one-half per cent of mono-hydrated nitric acid. The level in the reservoir being some centimeters higher than in the vessel of water, the outflow proceeds easily. The fluid thread hardens at once in the acidulated water, and may be drawn out by a uniform movement. The thread thus formed must be dried rapidly by traversing a current of dry (not hot) air, and may be wound up as soon as dry. It is gray or black, but a number of soluble coloring matters may be introduced into the ethereal solution, thus obtaining threads of all colors.—*M. De Chardonnet.*

How to Invest Nine Dollars.

By remitting $9 for the SCIENTIFIC AMERICAN, SCIENTIFIC AMERICAN SUPPLEMENT, and the ARCHITECT AND BUILDERS EDITION of the SCIENTIFIC AMERICAN for 1888, the subscriber will surely have the latest and best scientific, engineering, mechanical, architectural, and building information to be had, and it is only in these three publications that a great deal of the information they will contain can be had at all.

The number of engravings of new inventions, engineering works, scientific experiments, the elevation and plans of new buildings, etc., which have appeared in the three editions of the SCIENTIFIC AMERICAN during the year just closing reaches the large number of twenty-eight hundred and forty-nine. Every issue of the ARCHITECT AND BUILDER contains views of modern houses printed in colors, accompanied with scale drawings of plans in detail.

AN INTERESTING PATENT DISCUSSION IN THE SENATE

For several years past the Department of Agriculture has been conducting experiments with a view to promote and increase the production of sugar from cane and sorghum. The more recent of these experiments has resulted in important gains of sucrose by what is known as the diffusion process, which, in brief, consists in reducing the cane by cutters into thin slices, and soaking them in water. The solution is then boiled down in the usual manner.

In this way a larger yield of sucrose or saccharine matter is obtained than by the ordinary process of squeezing between rollers.

In the ordinary process of concentrating the sucrose, much trouble is occasioned by the acidity of the saccharine solution, which caused the inversion of the crystallizable sugar into glucose, resulting in great losses of sugar.

The Department of Agriculture undertook a series of special experiments, having in view the highly important object of discovering a practical mode of preventing the inversion and saving the sugar.

An appropriation of $94,000 was made to carry on these experiments, at Fort Scott, Kansas, under the general direction of Professor Wiley, a distinguished chemist. On July 19, 1886, the Hon. Norman J. Coleman, Commissioner of Agriculture, appointed Professor Magnus Swenson to be superintendent, to conduct the experiments, under the direction of the chemist.

Professor Swenson set to work most energetically, and it was not long before he hit upon the happy idea of preventing the invertive action of the organic acids in the cane chips upon the sugar during the process of extraction by adding lime to the saccharine or diffusion solution.

The remedy proved at once successful, and the important fact was immediately communicated to the Department of Agriculture by Professor Wiley, who gave ample and deserved credit to Professor Swenson for the suggestion and realization of the experiment. This was in December, 1886.

Very soon after making this new and valuable discovery, namely, on December 29, 1886, Professor Swenson applied for a patent, which, after long lingering in the Patent Office, was finally granted on October 11, 1887, number 371,528.

The discovery of Prof. Swenson appears to be rapidly gaining in importance. It seems likely to prove to be the key to the success of the sorghum sugar industry, and unless his patent can in some way be suppressed, he is likely to be handsomely rewarded for his invention. This is looked upon with horror by many people, who may be required temporarily to pay perhaps the one thousandth part of a cent per pound of sugar for the use of a discovery that may add untold millions of wealth to our agricultural resources.

Complaint has already been made to the Senate, and there seems to be a strong disposition in that body to throttle the patent before it has time to swell into a gigantic monopoly, like the barb fence, the driven well, the telephone or the telegraph, or the Standard Oil Company.

On the 15th of December last, Senator P. B. Plumb, of Kansas, submitted a resolution which was passed after being modified as follows:

"*Resolved*, That the Attorney-General be requested to investigate the issuance of letters patent No. 371,528 to Magnus Swenson, of date October 11, 1887, and if in his judgment the same is invalid upon any ground, or was procured by reason of information obtained from experiments made by the government, and if in his judgment a suit can be maintained in the name of the United States, that he commence suit promptly to have the same canceled or the use of the same by said Swenson or any one claiming under him perpetually enjoined."

Prior to passing the resolution a long discussion took place in regard to the jurisdiction of the Senate, the power of the Attorney-General, etc., in which a number of Senators took part; but only a few members made remarks touching the merits of the invention or the rights of inventors who are in governmental employ, etc.

The only man in the Senate who seems to have had the courage to say a word in behalf of the inventor was the Hon. Wilkinson Call, of Florida.

During the progress of the debate, Mr. Plumb said: "The subject matter of this resolution and the issuance of a patent to Mr. Swenson is of very great importance to the people of this country, because if Mr. Swenson's claim is substantiated it may prove that he has a very important control over the manufacture of sugar from sorghum, the value of which has been demonstrated by experiments made by the government, and the opportunity for the obtaining of this patent having been presented to Mr. Swenson by reason of his employment by the government. I should be very glad, therefore, to have the resolution passed, in order that the Attorney-General may be admonished to do whatever he may find legally within his power in the direction of setting aside the patent at an early day.

"If Swenson has a valid patent, he has it upon a mere technicality. Properly speaking, morally speaking, he has no right to a patent. He was in the employ of the general government; every step of the experiment which resulted in the development of this process was taken by reason of the expenditure of the public money, and except for the expenditure of public money this process could not have been developed, at least at the time that it was."

The Hon. J. B. Beck, of Kentucky, said: "From very long experience and observation here, I have found that whenever we constituted a board, whether it was to examine into guns, or ships, or anything that the government wanted, or even to a canceling stamp for the Post Office Department, and when we furnished them the money and all the facilities for making the investigation, and without our money and without the facilities furnished by us they would have had no idea of the suggested matters in the nature of improvements that they afterward patent; and thus we are constantly handicapped by men who have obtained all the information that enabled them to take out their patents through the means and instrumentalities that we have furnished, and through the money we have put into their hands for the purpose of doing it. If there is any way of breaking that up, I want to break it up.

"If I were to go over the history of the last twenty or thirty years of inventions that have been claimed by men who have been the trusted officers of the government to make improvements for the use of the government, in guns and in the machinery that we have needed, it would be found that a very large majority of the patents have been taken out by men who were in our employ, and who obtained the information to take them out by the means furnished by the government, and the information elicited under the investigations made with the money of the government. It can do no harm for us at least to get the opinion of the Attorney-General as to what our rights now are, so that we may guard against these abuses by law, if need be, in the future."

Mr. Call said: "I think there is a great deal of doubt whether the resolution ought to pass. I should be very willing to vote for a general law authorizing the Attorney-General to bring suits in all cases where there is reasonable cause to believe a patent invalid; but to declare that he shall bring suit to invalidate this patent because the inventor discovered the invention while in the service of the United States, or on the broader ground contained in the amendment, on account that it was in the course of experiments made by the United States, seems to me utterly illogical. Neither fact affords any ground whatever for declaring the patent invalid. Shall we limit the human mind in discoveries to facts which have not been elicited by government investigation? Why is not an invention as meritorious, why are not the operations of the intellect in discovering some great mechanical principle of benefit to mankind because the facts on which the intellect operated were discovered in the course of experiments made by the government and at its expense? The invention is of as much service, and has as much right, and is as commendable, and ought to be as much encouraged, if he discovers some great benefaction from facts elicited by the government as from any other source. The government has no claim on his thought, on the operations of his intellect, and I think the ground of this resolution therefore is entirely erroneous.

"This resolution declares, so far as the Senate has power to do so, that a man in the employment of the government who makes a new discovery of some law of nature, of some process heretofore unknown, shall not have the advantage of it, simply because he is in the employ of the government, and that all his intellectual faculties belong to it outside of the special purpose for which he is employed. I shall vote against it. A poor man's talent is all that he has, and the government does not need to take that away from him."

Mr. George.—"Suppose this discovery is made in the process of experiments carried on by an employe of government with the government's money, then what?"

Mr. Call.—"It does not make the slightest difference. The government does not buy the man's brain for anything but the special purpose for which it employs him, namely, for his use of the already ascertained laws of mechanical operation which may be used. It does not contract with him that whatever new discoveries may be made in the vast field of nature shall be compensated for by his employment to use those already known and discovered. There is no such contract, and there ought to be none. If a man discovers some great and new principle, some great benefaction to mankind, shall it be said because it was done with the government's money that that was contemplated in the contract? Certainly the proposition denies itself; the proposition that when a man contracts with the government to render a specific service he also contracts for all new discoveries in the unknown realm of nature which may be made by him.

"The government is a poor paymaster at the best, and invention will not be promoted by denying the inventors all benefit from their inventions. On the contrary, the power of monopoly, the power of money, will be promoted by the principle of securing the sale of a man's genius before he has made an invention.

"The Senator from Kentucky said that he had known for many years men in the employ of the government using the government's money in its experiments, and then obtaining a patent for some new invention that had been discovered in the course of their employment. If any such patent has ever been issued, it has been by the fraud of the Interior Department or their ignorance. The law has always been to the contrary. The law has always been that a discovery once used anywhere is a dedication to the public. The invention must be new and unused, and not put in service, or a patent cannot be obtained for it."

Hon. Henry M. Teller, of Colorado, said: "I have no objection to the resolution if the facts are as I understand them in this case, and if the law is, as it seems to me it ought to be, that the man who, while engaged in studying a single question for the government under its pay, discovers something greatly advantageous to the people of the United States while so employed, ought not to be allowed (although it is possible the law may permit it now) to obtain a patent for that discovery. He ought not, in equity and right, to be allowed a patent, and thus take the discovery away from the people and make it useful only to himself."

Hon. John Sherman, of Ohio, said: "This invention, made by an employe of the government with the aid of large expenditures of the government, is said to be one of the most valuable and important inventions made of late years, especially in regard to an industry that at this time excites more interest among the people of the United States than any other industry, that is, the question how to utilize the sugar in the beet and in the cane—sorghum in the various forms. If this patent is allowed to stand in the way of the active experiments that are being made in that important process, it will prevent the planting of beets; it will prevent the growth of sorghum; it will prevent further inquiry into the best means of making sugar from the various agricultural products which have been proposed; it will stop the experiments made by the government of the United States; and it is therefore not a slight thing. It is a matter of vital importance.

"I think we have the right, as the Senate of the United States, to direct the attention of the Attorney-General to this matter; to inquire in the first place whether he has the power to test the validity of this patent without a law of Congress; and in the second place to give us such information upon the subject as will enable us to prepare a bill that will enable the government of the United States in honor to withdraw its patent in case it has been illegally or fraudulently obtained."

Labor and Money.

The doctrine of the *power* of *law* to create monetary value degrades labor as its first effect, by fixing in the minds of the people the notion that labor is not the only source, perhaps not even the greatest source, of monetary value. It concedes to a rival power the domination of labor, by endowing that power with plenary potentiality to regulate the value and price of labor and all it produces. Hence labor would lower itself to a secondary rank in the production of values, whereas it is, in a scientific view, the primary and sole creator of value. Labor must either be master or slave. It must acknowledge no equal, no rival, no usurping, interloping competitor in the creation of the values of the world. If it takes any other than the foremost position among its rivals, its cause is hopeless. It will be led by the nose, like an ox or an ass, it will work in the yoke its rivals contrive for it, and, as has been the case in all past history, it will be regarded by the "money power" in the light of hewers of wood and drawers of water.—*Social Science Review.*

Lake Freight.

A marvelous record in lake marine annals was completed December 9 by the big propellers Jewett and Tioga, belonging to the Union Steamboat Company, when both came into port together, with flags flying and whistles blowing. They first left Buffalo together on the morning of April 26. Each had completed 25 round trips and sailed 46,000 miles, the Tioga having delivered 85,000 tons and the Jewett 75,000 tons of freight during the season. During the whole time neither has had to lie to for a single day for repairs.

The End of Another Year.

During the year now closing, our mail subscribers have received gratis an extra number of the SCIENTIFIC AMERICAN. The present volume closes with 27 numbers, thus giving the subscriber, at considerable cost to the publishers, 53 numbers for the year 1887, in place of 52. We hope our mail subscribers will recognize our liberality in presenting them with the extra number, and favor us with a renewal of their subscription promptly. And if any one can influence a friend to join him, who is not acquainted with the value of our publications, it will be a good thing for both his friend and the publishers.

THE SELF-REGISTERING BAROMETER.

The accompanying illustration represents a self-registering barometer that has recently been put into the office of the SCIENTIFIC AMERICAN. Similar instruments are now in use in the Harvard Observatory, the Lick Observatory, Wellesley College, Central Park Observatory, New York City, and the office of city engineer at Providence, and other places. This instrument is of a very high grade, and gives a weekly record of the barometric changes.

Without any attention, it registers on a paper supported by a flat tablet the changes in pressure. To make the readings clear, the proportions are so adjusted as to magnify the variations three times. On the chart each tenth as marked really measures three-tenths of an inch in height. This provides also for any minor inaccuracies due to varying thickness of the line marked on the paper by the indicator.

In general principle it operates by weighing the mercury in a cylindrical glass tube, which forms the cistern. This tube is suspended from the frame of the apparatus by two long steel springs. When the column rises, mercury enters the tube from the cistern. The latter is reduced in weight and also rises. When the column falls, more mercury enters the cistern, which, under the increased weight, stretches the springs and descends. Thus it will be seen that the cistern moves up and down in the same direction as the actual column.

The ratio of its motion to the true variation is adjustable by varying the strength of the springs. In some instruments a ratio of 2 : 1 is provided, but the larger rate seems the preferable. Thus, on the SCIENTIFIC AMERICAN instrument the hundredths divisions are so large that they can readily be fractioned.

For marker, a glass tube charged with red ink is adopted. This is carried in a horizontal position, attached rigidly to the cistern, and moving up and down with it. At one end it is drawn down to a small orifice. The ink forms a species of film between it and the paper, and a strong red line is traced on the chart.

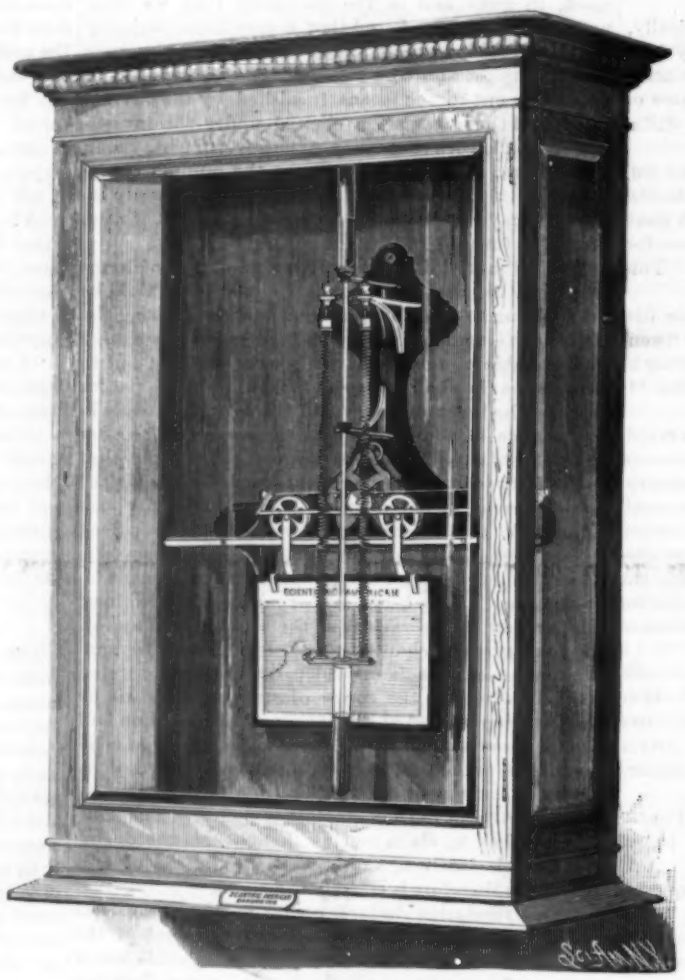
Two features of interest characterize the chart and its way of application. It covers the period of seven days. Thus the paper has to be replaced only once a week. This may seem a minor point, but it is far from being such, as it saves much trouble and the necessity for daily attendance at a specific hour. The other feature is the position of the chart. When receiving the curve of heights, the paper is stretched over a flat tablet that moves horizontally. Thus arranged, all the readings for the week, or for whatever portion may have elapsed, are visible. This arrangement is a great improvement over the cylinder or disk systems, neither of which is easily read for any period back, when held by the registering mechanism.

The adjustment for temperature is arranged by a system of compensation. As the temperature rises and the mercury decreases in specific gravity, normally the movements of the cistern would be affected. The changes in elasticity of the springs, under alterations in temperature, are mainly relied on to correct this. The expansion and contraction of the frame is also allowed for in the adjustment. The consequence is that the apparatus is self-correcting for changes of temperature.

The frame is of heavy cast iron, the working parts are of brass, and generally nickel plated. The tablet is moved by a cord which is carried once around a drum that is rotated by the clockwork. The tablet is suspended from two grooved wheels that move along a horizontal track.

This interesting instrument has now been at work for several weeks in the office of this paper, and has given a consecutive record of all changes, day and night, for that period. Owing to the use of ink, the curve is as well defined as if made by a drawing pen, and the old trouble incident to former types of recording instruments of endeavoring to follow a gray and obscure pencil mark is avoided.

The instrument was constructed by the Draper Manufacturing Company, of 152 Front Street, this city. The same firm also make other registering meteorological instruments, rain gauges, anemometers, etc., following, as far as may be, the same line of construction. The accuracy attained in some of their instruments is very remarkable. In one of their registering barometers no error exceeding three one-thousandths of an inch has, it is said, been observed.



THE SELF-REGISTERING BAROMETER.

AN impervious enamel for paper, wood, etc., is a solution of shellac in methylated spirit. A coating of this is applied, and then another coating laid at a high temperature and under great pressure.

The American Outlook.

Our English contemporary the *Colliery Guardian* takes an encouraging view of the prosperity for our railroad enterprises the next year.

The intelligence which has come to hand within the last day or two from the United States (says the editor) is of a more encouraging character. For some time past 1888 has presented itself in somber colors, so far as the American iron and steel trades are concerned; but we now learn that an impression is beginning to prevail that the demand for rails next year in the United States will, after all, be better than it was expected to be a few weeks since. Should what we may term the amended anticipation be realized, the attendant consequences can but be favorable to the iron and steel rail trades of Great Britain and western Europe, since if the American iron trade presents a fairly steady tone next year we may reasonably assume that matters will also move on pretty well upon this side of the Atlantic.

We have all along contended that there is a material difference between the panic of 1873 and the depression of 1887. In 1873 a large number of "wildcat" American railroads were projected, and sought to maintain a precarious existence with the aid of capital raised in England and Europe at heavy—and we had almost said usurious—rates of interest. It is to be feared that in too many cases these projectors of the "wildcat" schemes had little or no serious intention of fulfilling the engagements into which they entered. The inevitable result was a very serious collapse of American railroad credit, affecting alike all American railroad property, good, bad, and indifferent. From this collapse the recovery was so slow and painful that the ground lost can scarcely be said to have been recovered much before 1878.

When we endeavor to analyze the American railroad situation of 1887, we find a very different state of affairs happily existing. It is true that with their usual impetuosity American railroad men have somewhat overbuilt themselves in 1887, and that American railroad credit has been strained, to a certain extent, in consequence. But it must be borne in mind that American railroad companies have profited materially from the fall in the value of money which has taken place throughout the United States since 1873, while the work of railroad establishment has also been rendered easier by the great decline in the price of rails and rolling stock. Yet another distinction between the panic of 1873 and the depression of 1887 will be found in the fact that the new lines undertaken in the United States during the last three years have been of a more *bona fide* character than many of those projected in 1872 and 1873, while the capital required for the railroad works undertaken in 1885, 1886, and 1887 has been principally provided by the Americans themselves. A large extent of the new railroad mileage established in the United States since 1884 has also been carried out by previously existing American railroad companies, possessing a more or less solid and substantial credit, and fairly well able in consequence to sustain for a time the consequences of a check similar to that which we have witnessed during the last few months. In other words, the American railroad situation of 1887 bears the impress of far more respectability than was observable in the panic of 1873. We must take account still further of the consideration that since 1873 the United States have materially advanced in wealth and population, so that there has been far more real justification for the new railroads undertaken in the West, Southwest, and Northwest than could possibly be found in the "wildcat" projections of 1873.

It is in such considerations as these that we may find some explanation of the better prospect which appears to be now happily opening for the American railroad interest and for American iron in 1888. Cheaper capital, less costly *materiel*, greatly enlarged population, general industrial progress, and much more accumulated wealth—these are the supports upon which the American railroad interest and the American iron trade can happily now rely. It is probably a fact that the Americans are becoming a more industrial people than at any former period in their history. The United States are still *par excellence* the great industrial quarter of the world, since cotton growing is quite as much an agricultural pursuit as the raising of cereals or the grazing of live stock. But it is a happy characteristic of the natural resources of the great republic that they are surprisingly varied and comprehensive, and that they afford scope for the development of human industry in well nigh every form. This, it appears to us, is a point of material importance in connection with the future of the United States. A country which has only one industry must always be more or less in a precarious position, while a country with a multiplicity of industries is less exposed to climatic vagaries and commercial vicissitudes.

It is quite possible—indeed, it is extremely probable—that 1888 will witness a material contraction in American railroad construction. No nation in the world can go on building 10,000 or 12,000 miles of new line every year for an indefinite period; and, therefore, some check in American railroad establishment was inevitable. But, at the same time, it will be highly satisfactory if the shock which it was apprehended that the American iron trade would experience in 1888 in a severe form loses something of its intensity.

Good Material for Successful Engineers.

The *Railway Review* says: A number of our leading railway shops are taking in "engineering students," bright young men who come from the technical schools to learn the practical side of railway mechanics, and who enter as apprentices. They receive slightly more pay than the ordinary apprentices, but their wages are still merely nominal. The experience has been that when engineering students have been thus received, the benefit is mutual. These young men come into the shops fresh from their mathematics and their drawing tables, and while they absorb all that they can of the practicalities of their chosen work, they are found to be very useful by their employing officers, because of their familiarity with mechanical theory and drawing. There are not a few master mechanics in the country who are invaluable in their places—first class men in every respect—but who, in early life, had not the advantages of education which this younger generation of students has had, and they find many directions in which these educated young fellows are made useful. Especially useful are these students as a detail for special work of investigation. They are well equipped for such work, and they know how to make a good report on the same.

A New Tanning Agent.

By digesting coal dust with caustic soda at a boil and neutralizing this liquor with hydrochloric acid, the author obtains a new tanning agent, which he names pyrofuscine. He considers that the new process is more complicated than the usual tanning processes, but that it is 50 per cent cheaper than the bark process and 20 to 30 per cent cheaper than the alum process.—*P. F. Reisch, in Dingler's Ployt. Journal.*

A Practical Suggestion.

We know of no better way in which an employer of intelligent men can invest $3 than by subscribing for the SCIENTIFIC AMERICAN for a trusty superintendent, foreman, or other employe whose services for faithfulness he wishes to recognize. It would be a weekly reminder of the donor's generosity.

ALTERATIONS AND ADDITIONS TO A COUNTRY HOUSE AT POMFRET, CONN.—HOWARD HOPPIN, ARCHITECT.

A REMODELED HOUSE.

It frequently happens in the experience of the architect that he is called upon to enlarge or remodel a dwelling. Sometimes it is only required to add one or more rooms, while in other cases it is sought to improve the appearance of the exterior. Such problems often severely tax his ingenuity, for it becomes difficult to considerably improve the appearance of a building while substantially maintaining its original outlines.

As illustrating what may be done in this direction, we present to our readers a set of drawings, showing the ingenious and clever method of treatment adopted by Architect Howard Hoppin in dealing with the residence of Mrs. R. M. Clark, at Pomfret, Conn. This house, before alteration, presented the appearance of a comfortable, plain, country dwelling, as represented in the view in the upper right hand corner of our plate. The imposing appearance of it as it now stands can be seen from the large perspective view.

The alterations, although apparently so extensive, were, in fact, few beyond the addition of towers, the stone lining to some of the walls, and the new piazza. Scarcely a feature of the original house has been removed. It has simply been added to, and this in such a manner as to throw but little weight upon the old work.

The March, 1887, number of the ARCHITECTS AND BUILDERS EDITION of the SCIENTIFIC AMERICAN, from which this engraving is taken, contains detail drawings and a complete specification of the work, which cost about $7,000 to carry out.

A THIRTY-FIVE HUNDRED DOLLAR COTTAGE.*

*From the ARCHITECT AND BUILDERS EDITION of the SCIENTIFIC AMERICAN of October, 1886, in which the ground and chambers plan are given. This or any other numbers of the ARCHITECTS AND BUILDERS EDITION (26 ready for delivery) may be had by remitting 25 cents to the office of this paper.

What the World Owes.

The *Amateur Mechanic* thinks when a man has a conviction that the world owes him a living, the best thing he can do is to go to work and collect the debt, and there is no surer way than by work. It is the magic key to the most stubborn defenses. Steady, persistent, intelligent work has surmounted more difficulties than the brilliant sallies of genius or the temporary spurts of men without an object.

Many young men feel that they are unappreciated, and that if some one would only come forward and give them an impetus—a chance—they would take the world by storm! Doubtless there are many such who languish for want of opportunity, but the incipient genius must not wait for something to turn up. He must turn things up himself, and keep turning.

When he is sick of it, and wants to stop and take things easy, let him keep right on turning and all will turn out right!

Want of pluck has killed many an enterprise that had all the elements of success in it. The projectors joined the great ranks of the "unappreciated" after a few good strokes and fell out of the race, when a little more snap and "hang on" would have brought them into smoother sailing.

There is no battle call more stirring than "Up, guards, and at them!" and that must be the motto of every young man everywhere—we say the young man, because if the old has not learned it, it is too late for him to make the knowledge available.

"You don't know how hard it is to start a new business," said a friend the other day, at the head of a large and well-appointed concern; to which we made no reply, though we might have given a few appropriate remarks on the subject from our own experience.

Those who fancy that success depends upon luck or good fortune, or anything short of energetic, persistent hard work, will be undeceived if they embark in trade, and expect to have business roll in on them.

Want of capital is a drawback, but want of work is like a countermine to a mine, destroying the best plans and intentions.

The faint heart says, "There is no chance; there are so many in business already; the field is occupied," etc. In proportion to demand the field is no more occupied to-day than it was forty years ago, and if men have good wares, sell them at a fair price, deal honestly by all, and perform what they promise, their future is certain. The world owes every man a living, and will pay it if it is worked for.

J. PERSOZ finds that wool, if previously saturated with a 10 per cent solution of glycerin, can bear a prolonged exposure to 130° to 140° without injury.

Telephonic Communication at Sea.

Mr. H. F. Boyer, of H.M.S. Malabar, has recently made a number of experiments in this direction with an apparatus of his own invention. Previous attempts of the same general character by some American electricians were described in our issues of October 7 and November 4. The following description is given of the arrangement:

The source of sound consists of a large gong or flat bell supported against the side of the vessel below the water line. A straight tube leads from this gong to the "bridge" of the ship, and in its interior is a rod fitted with a handle at its upper end, by which the hammer of the gong can be worked, and the gong struck at will. The striking of the gong may, of course, be done in keeping with a code of signals, such as the Morse code used in ordinary telegraphy. In the center of the gong is fixed a modified Bell telephone with a large and sensitive diaphragm. The telephone is connected by means of wires running up the tube to a second telephone on the bridge, within reach of the observer there. This forms the receiving part of the apparatus. If we suppose two ships fitted with this combination, it is only necessary for one to rap out her message by striking the gong and for the other to receive it on her telephone. The sound waves from the transmitting gong traverse the intervening water and vibrate the diaphragm of the submerged telephone at a distance. These vibrations excite currents in the latter, which, in traversing the second or observing telephone, reproduce the original sounds of the gong. Small explosions of gun cotton under water have also been used by Mr. Boyer in place of the gong; and an ounce of gun cotton can in this way give a signal which is distinctly heard a mile off under water.

Such signals under the sea are independent of fogs or stormy weather; and they hold out the possibility of lighthouses and lightships being able to signal vessels at all times. Moreover, ships, in addition to signaling each other, could also signal lightships, or announce their number to Lloyd's stations, if the system prove successful. Mr. Boyer's plan, which so far has given encouraging results, is somewhat similar to that of Prof. Lucien J. Blake, of the Rose Polytechnic Institute, United States, which was described in our issue of November 4. Instead of a submerged telephone, however, it will be remembered that Prof. Blake uses a microphone in circuit with the deck telephone as a receiver. With this arrangement, Prof. Blake has been able to transmit subaqueous signals from a locomotive bell through a mile and a half of the Wabash River, comprising three or four windings. Mr. Edison also is reported to have signaled through a mile of the Caloosahatchie River, in Florida, during the present year. His system has not been fully disclosed, but it appears to be similar to those described. It is to be hoped that this new development of telephony will be pushed as far as possible.—*Electrician.*

JERSEY BULL DIAVOLO.

Oyster-Opening Monkey.

Mr. Alfred Carpenter, of the Marine Survey Office, Bombay, has observed Macacus monkeys on the island off South Burma opening oysters with a stone. They bring the stones from high water mark down to low water, selecting such stones as they can easily grasp. They effect the opening by striking the base of the upper valve until it dislocates and breaks up. They then extract the oyster with the finger and thumb, occasionally putting the mouth straight to the broken shell. The way they have chosen is the easiest to open the shell.

AMALGAMS present many peculiarities. Thus iron, antimony, sodium, silver, and gold will dissolve in mercury; but if antimony amalgam be mixed with sodium amalgam, the antimony is thrown out—iron also.

FINE TYPES OF PRIZE CATTLE.

The Jersey bull Diavolo, represented herewith, received the first prize in the yearling class at the New York State Fair in 1880, and was at that time the property of Hon. Erastus Corning, of Albany.

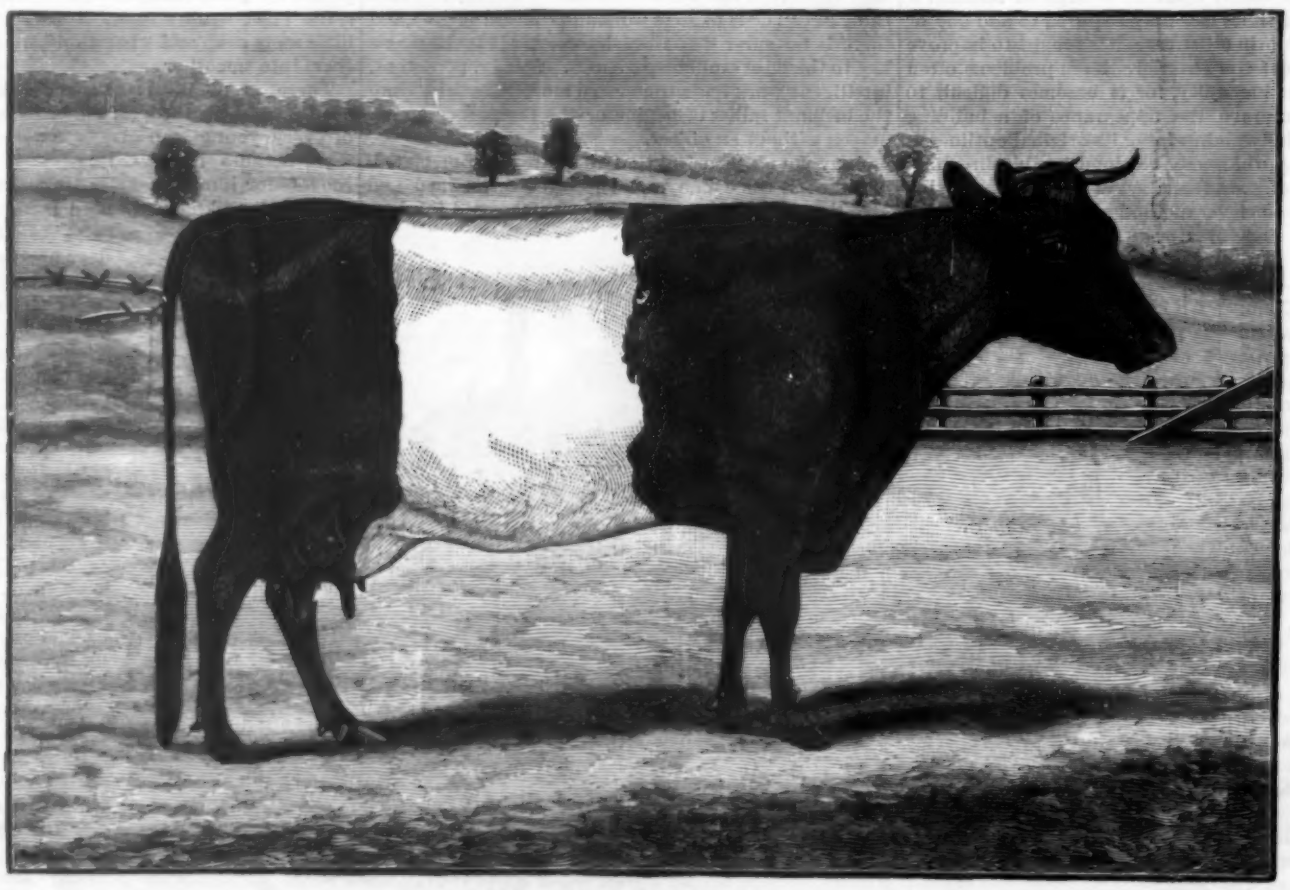
The Dutch belted cow Lady Aldine, shown in our engraving, is now owned by Mr. H. B. Richards, of Easton, Pa. She took the first prize in her class at the New Jersey State Fair, held at Waverly last September.

The Aldine family, of which our portrait is a good representation, have become famous as prize winners. The Dutch belted or blanket breed of cows are natives of Holland, and have not been brought to this country in large numbers. They antedate the seventeenth century, when the cattle interests in Holland were in the most thrifty condition, and this type and color were established by scientific breeding. The historian Motley well said: "These are the most wonderful cattle of the world."

In their native country they are owned and controlled by the nobility, and present a very novel feature in the landscape, grazing in the lowlands in Holland. In color they are black, with a continuous white belt around their body, the white being pure white, the black jet, making a beautiful and imposing contrast. Their form is usually very fine, and they are very productive as milkers.

The owner of Locust Grove farm, Michael Rosney manager, on Orange Mountain, N. J., has a small herd of the Dutch belted cattle. His stock is comprised of both the Aldine and Arnout breeds, five of which number received first and second premiums, according to their ages, at the State Fair where was awarded the first prize for Lady Aldine.

The Holstein cow Clothilde, owned by Smiths, Powell & Lamb, Syracuse, N. Y., has made herself famous by making a milk record of 28,021 pounds in one year.

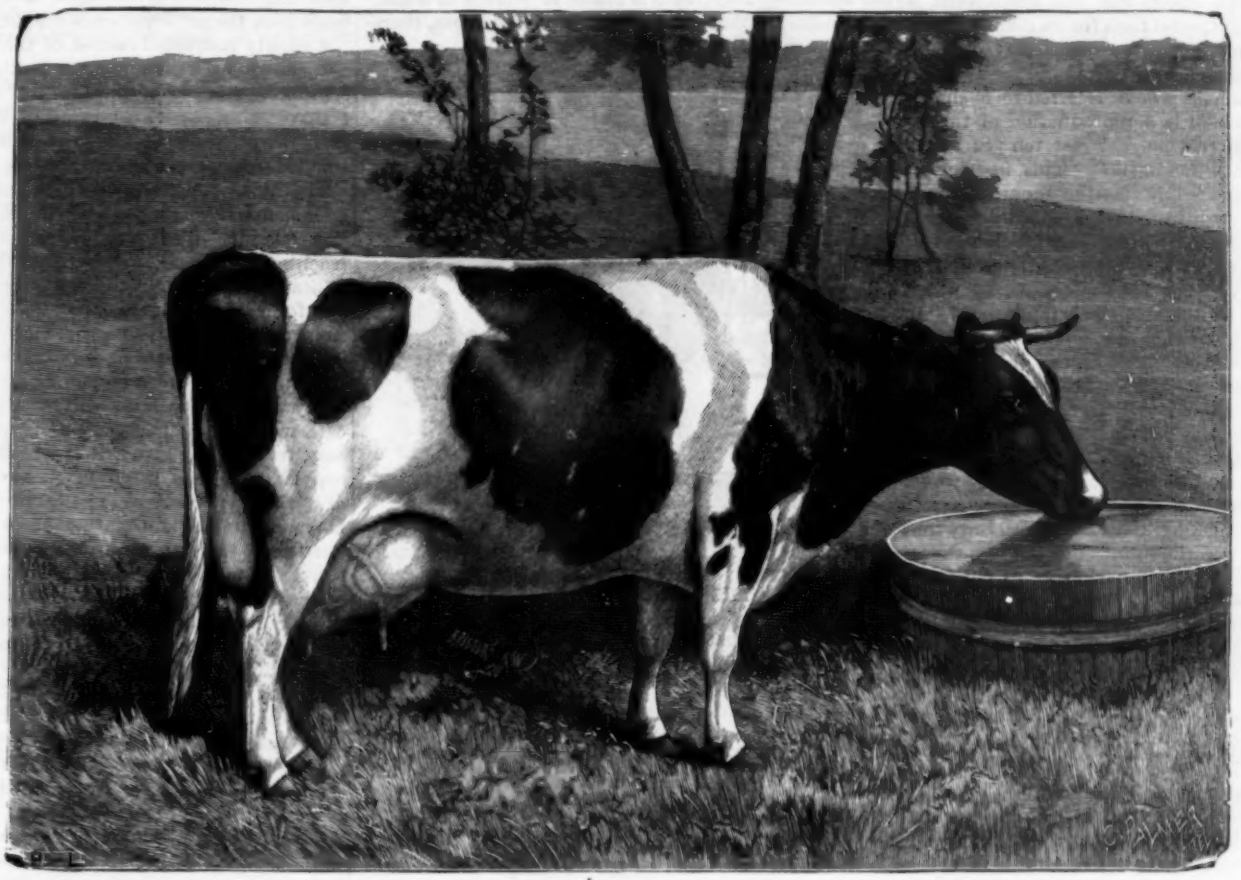


DUTCH BELTED LADY ALDINE.

She was exhibited at the New York Dairy and Cattle Show, where all the dairy breeds were shown, and the number of Jerseys exhibited was largely in excess of the number of Holstein-Friesians, and she won the sweepstakes prize for making the most butter in twenty-four consecutive hours, and according to a statement made to us by her owners, she has since given 101 lb. 2 oz. of milk in a day, and made 28 lb. 2¼ oz. of

butter in a week, which record there is probably no cow likely to dispute.

The other fine portrait is of a celebrated shorthorn cow, Tenth Duchess of Geneva, whose personal and



CLOTHILDE.

family history is somewhat remarkable. Tradition ascribes the origin of the family to a breed of cattle possessed for centuries by the family of the Duke of Northumberland, but the actual records commence in the last century, when an ancestress of this cow passed into the possession of Mr. C. Colling, of Ketton, Durham, who was one of the founders of the shorthorn as a distinct and highly improved breed. In 1804 Mr. T. Bates, of Kirklevington, Yorkshire, purchased one of the Duchess cows, and recognizing in her excellence and that of her male offspring the superiority of the family over the shorthorns he had previously owned, he determined to secure more of the sort, and at Mr. Colling's great sale, in 1810, when forty-seven animals of both sexes and all ages, from eleven years downward, made the then unprecedented average of $732.84, he gave $929.64 for the two year old heifer Young Duchess, afterward called First Duchess, a daughter of Comet (sold on the same occasion for $5,080), and grand-daughter of the cow he had first purchased. From that heifer in the female line direct sprang those Duchesses which have at different periods won the chief honors of the Royal Agricultural Society of England, and for many years past have commanded the highest prices at public and private sales. Mr. Bates, while practicing to a considerable extent the system of in-and-in breeding, crossed his Duchesses at different times with other approved shorthorn families, notably with those of Mr. Colling's Red Rose and Princess, thus combining what he considered three of the oldest and best shorthorn families in the kingdom. In 1853, at the Tortworth sale (after the death of Earl Ducie), Sixty-sixth Duchess was bought by Messrs. Becar & Morris, of New York, for $3,557.40.

Her descendants, having changed owners in America, were finally dispersed by auction in 1873, when Tenth Duchess of Geneva was bought by Mr. Berwick for the Earl of Bective at $35,000. She had bred in America the bulls Third Duke of Oneida, Sixth Duke of Oneida, and the heifer Eighth Duchess of Oneida, bought also for Lord Bective, at the same sale, for $15,000.

THE SHORT-HORNED COW TENTH DUCHESS OF GENEVA.

Overloading Cars.

Fifty-two thousand feet of bevel siding is the amount that a Chicago shipper recently shipped in a single car load to an up river dealer, and the latter objected to receiving it. He said he did not buy a whole lumber yard at a single purchase. The incident recalls the days when shippers considered 35,000 feet a big load, and resorted to all manner of schemes to get such a car load out of the yard and on its way east. Such overloading of cars may some day breed trouble—that is, if from overweight a car breaks down in transit, and a train hand is injured or killed by the accident, the responsibility may fall upon the shipper, or the agent who permitted the loading. One thing is certain, this view of such business is not unthought of by railroad officials, and some day it may be sprung on an individual who least expects it.

Referring to the above, we are reminded of numerous instances where the stock is piled to the very top of the car on one side, and within six inches of the top on the other. When this is done, it becomes impossible to unload the car only from one side, and it is a species of luck, when the car arrives at its destination, that the only side from which it can be unloaded is on the opposite side from the dealer's shed or from the driveway to which teams have access. "Time is money" everywhere, and it is not right to cause a buyer to lose the use of a team and one or more employes for perhaps half a day in the labor of "starting a car load," simply to accommodate a shipper in his desire to ship, say, 500 feet more lumber in a car than there is any reason for.—*N. W. Lumberman.*

Our New Navy.

The *Marine Journal* says: As a bit of a warning to those of our Washington authorities who would blindly follow the lines laid down by foreign builders of war ships and great guns, it is well to note that the English papers state that the machinery trials of the new steel armor plated cruiser Narcissus have "again proved unsuccessful." Viewed in the light of Captain Bunce's late report on the defects of the Atlanta, and its sister ship, the Boston, built on the same lines, yet untested, this information shows that absolute perfection is not yet assured by following foreign models. And it is also interesting to note that American shipbuilders foretold a number of the defects in the Atlanta demonstrated by the late trials. Would it not be well to build one war ship on a thoroughly American model, untrammeled by foreign precedents where counter to our own ideas?

THE NEW PHONOGRAPH.

(*Continued from first page.*)

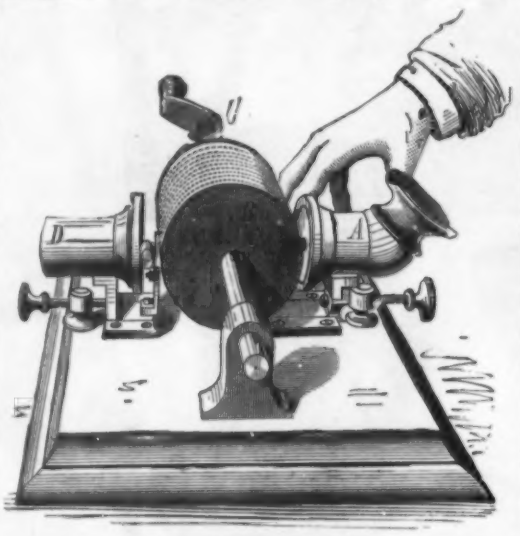
other well known inventions. He has recently devoted much time to the phonograph, and has not only perfected the instrument itself, but has established a factory provided with special tools for its manufacture, in which phonographs are to be turned out in large numbers, with interchangeable parts.

The original instrument above referred to is shown in one of our cuts, which is a reproduction of the engraving published in this journal just ten years ago, in the issue of December 22, 1877. This instrument consists of three principal parts—the mouthpiece, A, into which speech is uttered; the spirally grooved cylinder, B, carrying a sheet of tin foil which receives the record of the movements of the diaphragm in the mouthpiece, A; and a mouthpiece, D, by which the speech recorded on the cylinder is reproduced. In this instrument the shaft of the cylinder, B, is provided with a thread of the same pitch as the spiral on the surface of the cylinder, so that the needle of the receiving mouthpiece is enabled to traverse the surface of the tin foil opposite the groove of the cylinder. By careful adjustment this instrument was made to reproduce familiar words and sentences, so that they would be recognized and understood by the listener; but in general, in the early phonographs, it was necessary that the listener should hear the sounds uttered into the receiving mouthpiece of the phonograph to positively understand the words uttered by the instrument.

In the later instruments, such as were exhibited throughout the country and the world, the same difficulty obtained, and perfection of articulation was sacrificed to volume of sound. This was necessary, as the instruments were exhibited before large audiences, where, it goes without saying, the instrument to be entertaining had to be heard. These instruments had but one mouthpiece and one diaphragm, which answered the double purpose of receiving the sound and of giving it out again. Strangely enough, the recently improved phonograph is more like the original one than any of the others. It is provided with two mouthpieces, one for receiving and one for speaking.

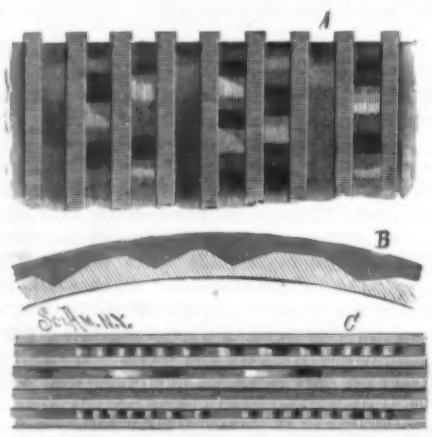
The new phonograph, which forms the subject of the larger illustration, is of about the size of an ordinary sewing machine. In its construction, it is something like a very small engine lathe; the main spindle is threaded between its bearings, and is prolonged at one end to receive the hardened wax cylinder upon which the sound record is made. Behind the spindle and the cylinder is a rod upon which is arranged a slide, having at one end an arm adapted to engage the screw of the spindle, and at the opposite end an arm carrying a pivoted head, provided with two diaphragms, whose positions may be instantly interchanged when desirable. One of these diaphragms is turned into the position of use when it is desired to talk to the phonograph, and when the speech is to be reproduced, the other diaphragm takes its place. The diaphragm which receives the speech and makes the impressions upon the cylinder is shown at 3 in one of the small cuts. The needle by which the impressions are made in the wax is attached to the center of the diaphragm, and pivotally connected to a spring arm attached to the side of the diaphragm cell. The device by which the speech is reproduced is shown in section at 4. The cell contains a delicate diaphragm of gold beater's skin, to the center of which is secured a stud connected with a small curved steel wire, one end of which is attached to the diaphragm cell. The spindle of the phonograph is rotated regularly by an electric motor in the base of the machine, which is driven by a current from one or two cells of battery. The motor is provided with a sensitive governor which causes it to maintain a very uniform speed. Motion is transmitted from the motor to the spindle by beveled friction wheels. The arm which carries the diaphragms is provided with a turning tool for smoothing the wax cylinder preparatory to receiving the sound record.

The first operation in the use of the machine is to bring the turning tool into action and cause it to traverse the cylinder. The turning tool is then thrown out, the carriage bearing the diaphragms is returned to the position of starting, the receiving diaphragm is placed in the position of use, and as the wax cylinder revolves, the diaphragm is vibrated by the sound waves, thus moving the needle so as to cause it to cut into the wax cylinder and produce indentations which correspond to the movements of the diaphragm. After the record is made, the carriage is again returned to the point of starting, the receiving diaphragm is replaced by the speaking diaphragm, and the carriage is again moved forward by the screw, as the cylinder revolves, causing the point of the speaking diaphragm to traverse the path made by the recording needle. As the point of the curved wire attached to the diaphragm follows the indentations of the wax cylinder, the speaking diaphragm is made to vibrate in a manner similar to that of the receiving diaphragm, thereby faithfully reproducing the sounds uttered into the receiving mouthpiece.

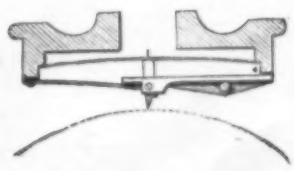


THE FIRST PHONOGRAPH.

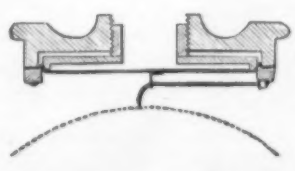
A crucial test of the capabilities of this machine was recently made in our presence, at Edison's laboratory, near Llewellyn Park, Orange, N. J. A paragraph from the morning newspaper was read to the machine in our absence, and when upon our return to the instrument it was reproduced phonographically, every word was distinctly understood, although the names, localities, and the circumstances mentioned in the article were entirely new and strange to us. Another test of the perfection of the machine was the perfect reproduction of whistling and whispering, all the imperfections of tone, the half tones and modulations even, being faithfully reproduced. The perfect performance of the new instrument depends upon its mechanical perfection—upon the regularity of its speed, the susceptibility of the wax cylinder to the impressions of the needle, and to the delicacy of the speaking diaphragm. No attempt is made in this instrument to secure loud speaking—distinct articulation and perfect intonation have been the principal ends sought.



PHONOGRAPHIC RECORD MAGNIFIED.



RECEIVING DIAPHRAGM.



SPEAKING DIAPHRAGM.

A highly magnified section of the phonograph cylinder, showing the indentations, is illustrated; A representing a section of the face of the cylinder, B a transverse section of a portion of the cylindrical wax shell, and C showing a less magnified face view of a small portion of the cylinder.

The new phonograph is to be used for taking dictation, for taking testimony in court, for reporting speeches, for the reproduction of vocal music, for teaching languages, for correspondence, for civil and military orders, for reading to the sick in hospitals, and for various other purposes too numerous to mention.

Imagine a lawyer dictating his brief to one of these little machines; he may talk as rapidly as he chooses, every word and syllable will be caught upon the delicate wax cylinder, and after his brief is complete he may transfer the wax cylinder to the phonograph of a copyist, who may listen to the words of the phonograph and write out the manuscript. The instrument may be stopped and started at pleasure, and if any portion of the speech is not understood by the transcriber, it may be repeated as often as necessary.

In a similar manner a compositor may set his type directly from the dictation of the machine, without the necessity of "copy," as it is now known.

Mr. Edison informs us that the whole of Nicholas Nickleby could be recorded upon four cylinders each 4 inches in diameter and 8 inches long, so that one of these instruments in a private circle or in a hospital could be made to read a book to a number of persons. The multiple earpiece by which this is accomplished is shown in one of our engravings.

The little wax cylinders upon which the record is made are provided with a rigid backing and the cylinders are made in different lengths; the shortest—1 inch long—having a capacity of 200 words, the next in size 400 words, and so on. These cylinders are very light, and a mailing case has been devised which will admit of mailing the cylinders as readily as letters are now mailed. The recipient of the cylinder will place it on his own phonograph and listen to the phonogram—in which he will not only get the sense of the words of the sender, but will recognize his expression, which will of course have much to do with the interpretation of the true meaning of the sender of the phonogram.

A very interesting and popular use of the phonograph will be the distribution of the songs of great singers, sermons, and speeches, the words of great men and women, music of many parts, the voices of animals, etc., so that the owner of a phonograph may enjoy these things with little expense.

It may even be pressed into the detective service and used as an unimpeachable witness. It will have but one story to tell, and cross examination cannot confuse it.

Extensive preparations for the manufacture of the phonograph have been made, and it is probable that within a short time these instruments will be as common and as indispensable as the sewing machine or the type writer.

THE PHONOGRAPH IN COURT.

The Trial of the Chicago.

This new war steamer lately went on her first trial up Long Island Sound. Capt. Robeson, commanding the Chicago, and Mr. Thomson, her chief engineer, report that the trial was successful; that her engines worked easily and with no sign of weakness, and that she made an average of fifteen knots per hour, reckoning on the resistance of the tides, in a trial of six consecutive hours. The pounding and thumping noticed in the first dock trial of her engines disappeared with the alteration of the valves; there was no need of resorting to forced draught; her steering capacity was all that could be desired; she was steady and free from immoderate vibrations.

In the Chicago's trial on the Sound the horse power developed has not yet been officially made known, but it is believed to be less, on an average, than the 5,000 which the contract calls for. The average speed secured is also somewhat less than was expected, as it was thought that this might be near sixteen knots. Still, on the whole, the results are thought satisfactory. The type of engines used is wholly experimental in war vessels, though known to a small extent on merchant steamships.

A VERY useful polishing powder for metals and glass is made of very finely ground glass mixed with a small proportion of dried soda ash.

FILM PHOTOGRAPHY.

The desire of amateur and professional photographers to employ a substitute for glass in photography, on account of its excessive weight and liability to break, has led to the introduction of paper as support for the sensitive film and to the manufacture of improved and new apparatus especially designed for operating the paper.

A negative on paper answers all the requirements of one on glass, except that it requires a trifle longer time

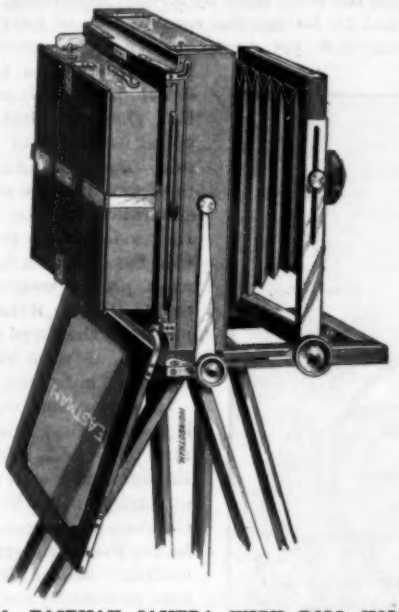


Fig. 1.—EASTMAN CAMERA WITH ROLL HOLDER ATTACHED.

to print from; but quite recently this objection has been overcome by the production of a specially prepared film, which may be readily separated from its paper support after exposure and development, and afterward transferred to a transparent, flexible gelatine support, thereby making a negative equal in every respect to glass, and also superior to it from the fact that it is non-breakable, more compact, more durable, and can be printed from on both sides, adapting it readily for photogravure purposes, for which reversed negatives are required.

For the civil engineer, geologist, mining engineer, and tourist the film is especially useful, since the weight of glass is avoided, and supplies may easily be obtained through the mails.

We illustrate a new form of camera, adapted for use with a special roll holder or with the ordinary plate holder, as the operator may wish.

Fig. 1 represents a perspective view of the improved Eastman interchangeable camera, in which are to be seen the valuable points desirable in a camera: a front focus, an excellent double rising front, a novel yet simple means of obtaining a horizontal swing, a device for making a side swing, a peculiar but practical plan of attaching the ground glass to the back, by means of which it is instantly adaptable for focusing when either a roll holder or a plate holder is employed, a reversible back, enabling the operator to take pictures upright or horizontally, and a special construction of the bed, which permits the entire back and bellows to be removed and replaced with another back and bellows of larger or smaller dimensions. In addition to all these merits, the camera is made of the very best mahogany, is highly finished, extremely strong, very compact, light, and rigid.

In Fig. 2 is seen the back removed from the bed of

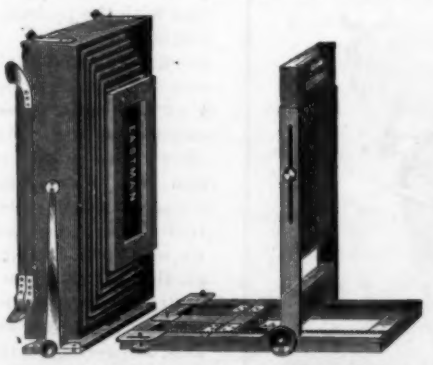


Fig. 2.—CAMERA WITH BACK REMOVED.

the camera, and how different sized backs may be adapted to one bed.

The bottom piece of the back is clamped to the bed by means of two thumb screws. Slots are made in the two side plates on the bed to permit the vertical side swing of the bottom plate.

Fig. 3 illustrates the advantages the camera possesses in having a double rising front and a swing backward of the front frame. It also shows the way in which the back of the camera swings on the pivot at the end of the upright arm. The entire front of the camera is raised upward through the slotted side uprights and clamped, then the lens board on the front may also be pushed upward as shown. This feature is of great usefulness in photographing objects of great altitude, such

Fig. 3.—THE DOUBLE RISING FRONT.

as high buildings, church steeples, etc., enabling the operator to get pictures without distortion of lines.

In Fig. 4 is seen the new construction of the ground glass frame, and the peculiar mode of fastening it to the reversible back frame of the camera.

The curved metal end pieces at the bottom are attached by a short link. When used for focusing, this link is pushed inward, which allows the ground glass to shut up tightly against the frame, as shown in Fig. 5.

The curved slotted spring catches at the top, when pushed outward; slip over a pin on the end of the ground glass frame, and lock it as in Fig. 5.

Fig. 4.—THE ADJUSTABLE GROUND GLASS.

After focusing, if an ordinary plate holder is to be used, the ground glass frame is pulled outward, as in Fig. 6, and the holder pushed in between it and the back and clamped thereto. When the thicker roll holder is employed, the ground glass hangs down, as in Figs. 1 and 4.

Fig. 7 shows an exterior perspective view of the improved Eastman-Walker roll holder, adapted for holding a spool of sensitive paper behind the camera.

In Fig. 8 may be seen the special improvements recently perfected. Formerly the working mechanism for transfering the paper from one spool to the other

Fig. 5.

Fig. 6.

was supported on a metal frame attached to the removable back board. Now this frame is dispensed with and the spools instead are secured directly to and between the two wood sides of the box, while the front is covered by a removable frame holding the dark slide, plainly seen in the lower view in Fig. 8. Besides these improvements, special mechanism has been introduced for indicating the number of exposures that are made. The changes have made the holder much lighter, more accessible, and more complete.

It has been the study of the manufacturers to invent methods and apparatus which will prevent failures and insure the successful working of the improved film.

We have described but a few of the devices that have been devised. The simplicity of the film, its certainty, and easy handling make it a most useful article for the photographer.

Fig. 7.—IMPROVED ROLL HOLDER.

We understand the Eastman Dry Plate and Film Co., of Rochester, N. Y., the manufacturers of the above mentioned apparatus, are prepared to furnish complete outfits and all accessories to any wishing in-

Fig. 8.—INTERIOR AND SLIDE FRONT OF THE ROLL HOLDER.

formation, and will send, on application, a descriptive catalogue, and for two 2 cent stamps a sample film negative made by their process.

Engraving with Mercury and its Salts.

It is known that when mercury is deposited on a metal, fatty lithographic ink will not "take" upon it when an inking roller is passed over it, and that the black adheres to the untouched parts of the metal. If a well polished and clean plate of zinc is taken, and a design is traced thereon with mercury, the design will appear in brilliant white upon the gray background of the zinc. After tracing the design an intaglio plate can be obtained by plunging the plate, without being coated with varnish, into a bath containing 100 parts of water and two parts at least of nitric acid. The action of the acid is very rapid, and for a long time only attacks the parts touched by the mercury. When deep enough, it can be used for lithographic work. If, instead of nitric, hydrochloric acid is used, the contrary effect takes place. The unaffected zinc is strongly attacked, and the traces of the mercury give a relief plate which can be used for ordinary typographical work.

If the operator does not wish to draw upon zinc, the design can be traced upon paper with a salt of mercury. The sheet of paper being then applied for two hours to a plate of zinc, the drawing is sharply reproduced in white lines of amalgam on the gray surface of the metal, just as if it had been traced directly.

The same result is obtained if the design is traced upon paper with a sticky substance (ink containing gum or sugar), and if it is dusted over with a mercury salt in fine powder. On dusting off the surplus and applying the sheet containing the design to a plate of metal, the same result is obtained. The same result is obtained if a newly printed proof is used, and is dusted with mercury salt while the ink is still wet and sticky. All the lines thus reproduced are chemically engraved, as has been described above. The same results are obtained by dusting with mercury salts a photographic carbon print containing a gummy substance, and the effect of half tints is even secured.

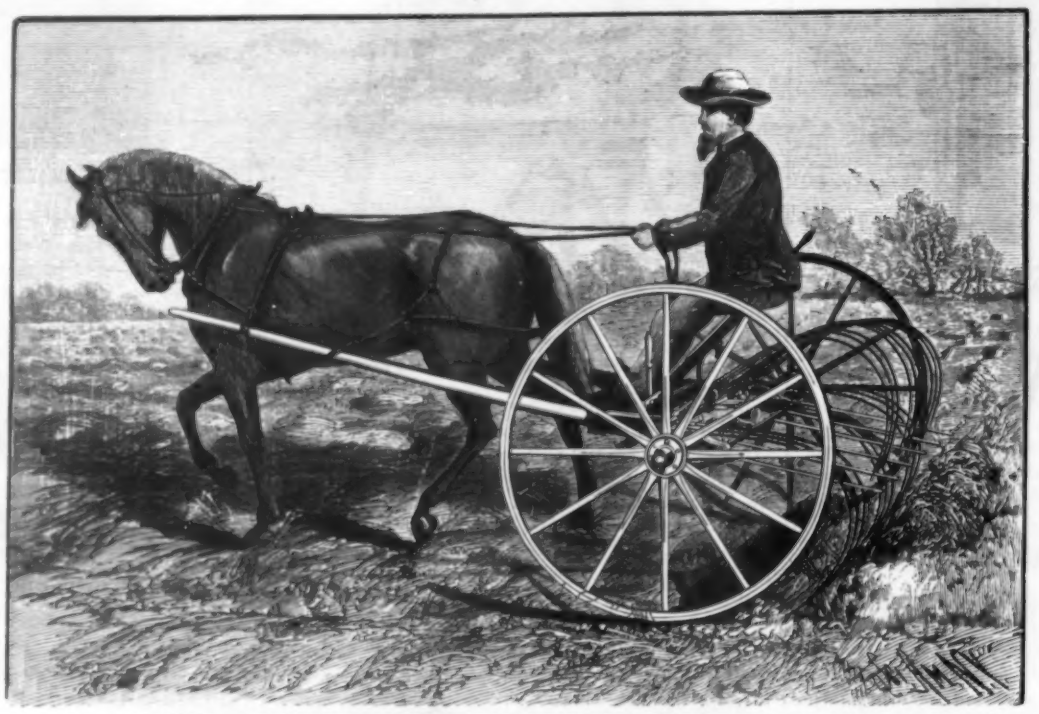
Biniodide of mercury is the salt to use.—*Memorial Industrielle.*

Mutually Benefited.

Some employers are in the habit of presenting their employes with books treating upon such subjects as pertain to the class of business in which they are engaged. It is a good idea, as both the giver and recipient are thus mutually benefited. Other employers furnish a library of well selected books and a reading room, to which all their help have access, which is a still better scheme. A catalogue comprising more than one hundred pages, containing a list of several hundred books, useful and practical, in every department of science, engineering, mechanics, architecture, optics, etc., has been prepared with great care by the editors of this paper, and will be mailed free to all applicants. The catalogue states the price by mail for each book or series of works.

A COMBINED HAY RAKE AND TEDDER.

A machine which may be changed, at will, either to rake or ted hay, which is also light-running, without cog gearing, springs, and other unnecessary parts, and which the driver can change, as desired, from one service to the other without leaving his seat, has been patented by Messrs. Israel L. Landis and Albert and Anthony Iske, and is shown in the accompanying illustrations, one view representing the work of tedding, and the other of raking hay. The frame or truck has hangers in which is journaled the main axle, one of its wheels having a pawl lever engaging a ratchet on the shaft, to rotate it when the machine is moving forward, but allow the shaft to remain idle when backing, to prevent unnecessary turning of the tedding teeth. The pawl lever is allowed to spring laterally, and is moved back of a pin fixed to one of the spokes of the wheel to disengage the pawl when the machine is used as a rake, and adjusted front of the pin when used as a tedder. The tedding or rake teeth are arranged in sets, clamped between heads, preferably made of cast metal and semi-cylindrically recessed to set over a parallel shaft having bearings in the main frame, and turn partially thereon independent of each other. The lower portions of the heads have rearward cam projections and forwardly projecting lips, the cam extensions on the heads engaging arms on the main shaft to operate the sections alternately when the machine is employed as a tedder, but clearing the arms when the machine is doing raking duty. The main shaft has an adjustable collar, by means of which the longitudinal movement of the frame may be limited so as to bring the tappet arms into range with the respective cams, this being accomplished by a lever near the front of the main frame, while a foot rest or lock frame is provided with detents by which the lever is held in position, as the machine may be used for a rake or tedder. A lever with its handle near the driver's seat can be operated to raise the rake teeth, being connected with a longitudinal bar to hold the rake teeth to move simultaneously when desired, the bar having a weighted lever under control of the driver by which it may be operated to set and unset the rakes. A transverse bar carries clearing arms which extend rearwardly between the rake teeth, and this bar may be clamped to hold the clearing fingers at any desired inclination. The driver's seat is pivoted, and has a slotted shank which is adjustably secured to an inclined standard. The operating hand lever is used for raising and depressing the rake teeth, to gather the hay on the forks and deposit it in windrows, and in the upper head of each rake or tedder section is a spring to keep the rake teeth yieldingly down to their work. As a tedder, the machine is designed to slowly and effectually turn the hay over, separating the bunches so as to permit a free circulation of air through all parts, and facilitate its proper drying.



LANDIS COMBINED RAKE AND TEDDER—TEDDING THE HAY.

LANDIS COMBINED RAKE AND TEDDER—RAKING THE HAY.

For further information relative to this invention address Mr. Israel L. Landis, Lancaster, Pa.

A Horse in Spectacles.

In the last issue of the SCIENTIFIC AMERICAN we published an account of the experiment of fitting spectacles to a short-sighted horse, in England, which had proved satisfactory, and now we have to record a similar experiment by a farmer up in Connecticut. A contemporary thus describes it:

A horse with goggles was one of the attractions at Bridgeport, Conn., a short time ago. The Manlius farmer who owned him said he discovered recently that the animal was very near-sighted, and an oculist took the necessary measurements, and, sending to New York, had a pair of concave spectacles made expressly for Dobbin. When the farmer tried them for the first time, the horse appeared to be startled, but recovering from his surprise, manifested every symptom of pleasure. They are made so as to be firmly fastened in the headstall, and cannot be worn without that piece of harness. "When I turn him out to pasture," said the farmer, "he feels uneasy and uncomfortable without his goggles, and last Sunday he hung around the barn and whinnied so plaintive like that I took out the bit and put the headstall and goggles on him, and he was so glad that he rubbed my shoulders with his nose. Then he kicked up his heels and danced down to the pasture. You ought to have seen him. I hate to let him wear specs all the time, though, for fear he will break them."

Aluminum Bronze for Cannons and Machinery.

The extraordinary properties possessed by the aluminum alloys has for upward of a year been a subject of frequent comment. It has been suggested as a material for structures in which lightness was to be combined with strength. Recently some tests under government auspices have been made at the Watertown arsenal by the testing machine illustrated in our last issue. The alloy tested was aluminum bronze, a compound characterized by the presence of copper and aluminum. The former metal forms by far the largest portion. The tests were applied to the grade known as A 3. One sample cast in sand gave a tensile strength of 53,000 lb. to the square inch, and an elongation of 6·2 per cent before breaking. Another sample of the same metal cast in chilled moulds resisted a strain of 67,000 lb. before giving way. The elongation was 13 per cent.

These very extraordinary figures appear so favorable in comparison with steel that the new aluminum copper alloy may be adopted in the construction of machinery for the vessels of the navy. While it is true that the cost per pound of the bronze exceeds that of steel, the fact that intricate castings can be made from it counterbalances the item of greater first cost. The expense incident to forging and shaping steel will be largely saved.

But it is not only for machinery that there is an outlook for the bronze. It may yet prove the solver of the problems involved in the construction of large cannon. In spite of the work done by Krupp, Armstrong, Whitworth, and De Bange, the construction of heavy ordnance has not yet been brought to perfection. The tendency is to construct built-up cannon. But these inevitably involve elements of weakness. The jars and heating to which they are subjected strain their many joints. In service, large pieces of this construction have always proved wanting. A cast metal gun, if the metal possessed the proper qualities, would seem the perfection of ordnance.

In aluminum bronze it is possible that this metal may be found. It was the subject of a recent lecture at Annapolis, by Mr. A. H. Cowles. He began by alluding to experiments with ordinary bronze for cannon, as recently conducted in Austria. He said that for gun manufacture he would start with an aluminum compound of 70,000 lb. tensile strength per square inch. Its elastic limit should be 23 000 lb. per square inch. This means that, if such a stress was applied to it, it would, on being released, return perfectly to its original contour without permanent deformation. Having cast the gun, he would next force mandrels through the bore to compress the metal near it, which would increase the strength of the critical layer of metal that first receives the strain of the explosion to 100,000 lb. per square inch. The elastic limit would be thus increased for the same layer of metal to 60,000 or 70,000 lb. Such a gun, the lecturer believed, would stand four times the strain that can be endured by a built-up gun.

There is no question that there is food for much thought in the suggestion, and that the new metal should be critically experimented with. The ordnance of Europe is far from perfect, as we have said. If it was ascertained that the bronze was all that it seems to be, if it was found that it was manageable for large castings, and was not subject to erosion in the bore, the government of this country could at one step become the equal of other lands in artillery. In using a metal that can be cast, and that is benefited by chilling, the plant would be simplified and a rapid production of guns would be insured.

Metallic Derivatives of Acetyl-acetone.

The author has shown in former memoirs that the hydrogen atoms of the central chain, CH_2, characteristic of acetyl-acetone, present remarkable analogies with the hydrogens of the acid hydroxyls. They are not attacked by the direct action of chlorine, and they can be easily substituted by sodium. He now shows that acetyl-acetone and its homologues act upon metallic salts like true strong acids, and that we may thus obtain with all the metals a new class of definite crystalline compounds, the acetyl-acetonates, answering to the general formula $(C_5H_7O_2)nM$, M being a metal of n atomicity.—*Alphonse Combes.*

VANILLIN is not a satisfactory substitute for vanilla, according to several American pharmacists. Even when coumarin is added to the essence, the flavor gradually becomes weaker.

ENGINEERING INVENTIONS.

A car coupling has been patented by Mr. Fred Tiedt, Sr., of Euclid, Minn. It is a double coupler designed to automatically couple with an opposing coupler of like pattern, and with provision for coupling with the ordinary link drawhead without changing the links or interfering with the arrangement of the improvement.

A lubricator has been patented by Mr. Patrick Brownley, of St. John, New Brunswick, Canada. It is adapted for use in connection with the steam chests of locomotive, hoisting, and other engines, and is made not to depend upon suction or the formation of a vacuum for the proper operation of the lubricator valves.

A car coupling attachment has been patented by Mr. Stephen D. Smith, of Spotswood, N. J. It consists of a folding frame carrying a lever, a nose being pivotally mounted within the frame, and arranged to support the free end of the outer coupling link and be held in position by the lever, making a "three link coupling," which may be coupled without trainmen going between the cars.

AGRICULTURAL INVENTION.

A planter and drill has been patented by Mr. Russell Brock, of Gladstone, Ohio. This invention relates to a corn planter designed to open a furrow, clear the soil of weeds in advance of the shovel, provide means for dropping the seed at regular intervals, and cover the seed when dropped.

MISCELLANEOUS INVENTIONS.

A faucet has been patented by Mr. George W. Aldrich, of Brooklyn, N. Y. It has a loose removable and revoluble valve support or seat, of spider like or open work construction, within the adjustable nozzle section of the faucet, and a soft or flexible and elastic ball valve, preferably of rubber.

A key hole guard has been patented by Mr. Alfred J. Urlin, of Missoula, Montana Ter. This invention provides a slide block preventing persons seeing through the keyhole, or the admission of cold air, etc., and also preventing the key from being turned from the outside, or from falling out of the lock.

An explosive compound has been patented by Mr. Lucien G. Heusschen, of Paris, France. It is made with coal oil or naphthaline and glycerine, mixed with nitrate of potash or soda, suphuric acid and sulphate of iron, together with carbonaceous matter, as carbonized tan or sawdust, and also sulphur.

A reel has been patented Mr. Frederick Eitapenc, of Oneonta, N. Y. It is intended more particularly for holding lead pipe in coiled condition, and safe from injury during transportation or shipment, the invention covering certain novel features of construction and combinations of parts.

A jail window has been patented by Donald McDonald, of Louisville, Ky. Combined with gratings set in grooved stones is a hinged or swinging sash, with connecting rod and operating cord, to prevent tools and other things being handed in to prisoners, while providing for the admission of light and air.

A tablet binder has been patented by Mr. William B. Pearson, of Jacksonville, Ill. Combined with covers and a flexible back is a metallic strip connected to the back and formed with a lug or ear, a folding clip and side clips, it being feasible to use a single binder for a number of tablets in succession.

An oven door has been patented by Mr. John R. Conrad, of Long Pine, Neb. It has a T-shaped opening covered with graduated transparent material, a securing plate and a socket in which is a thermometer, for accurately indicating the heat of the oven, and for inspecting its contents without opening the door.

A pegging jack has been patented by Mr. Nathaniel Kinney, of Amity, Democracy P. O., Ohio. It is made in sections so connected that the upper section carrying the shoe clamp may be raised and lowered to adapt it to different heights, the invention covering various novel features of construction and arrangement of parts.

A longitudinally expanding roller has been patented by Mr. Arnold W. Schlichte, of New York City. It has sheathing plates arranged to be moved backward and forward upon the face of the roller, the plates being gradually drawn outward as the roller moves forward, and rapidly forced inward as they arrive at a certain predetermined point.

An elevator gate has been patented by Mr. Eugene F. Hardin, of Lincoln, Neb. It is fitted to slide in vertical guides fixed to the side posts at the shaft opening, these posts being hollow to receive weights, making a simple and effective safety gate which will be opened automatically by the rising carriage, and closed automatically as the carriage farther ascends or descends.

A gate has been patented by Mr. Gus H. Ingersoll, of Franktown, Col. It is adapted to be opened and closed by the wheels of passing vehicles, or may be opened from the vehicle while horses are traveling either way toward the gate, and may be automatically closed behind the vehicle, the invention covering various novel features for the making of a simple and inexpensive gate.

An egg beater and mixer combined has been patented by Mr. Louis Rosenkranz, of Rhinebeck, N. Y. It is so made that as a crank shaft is revolved beaters are carried around a central shaft to cut and agitate the material in the body of the receptacle, elevating it also from the bottom toward the top, the action of the apparatus being such that it not only beats the material, but thoroughly mixes it at the same time.

A numbering head for printing presses has been patented by Mr. John G. Sauer, of New York City. It is made with a main casing and inner frame carrying the numbering disks, arranged to receive an out and in movement in the main casing from contact with the platen of the press, thus turning the numbering disks for consecutively numbering the sheets as they are printed.

A shutter fastener has been patented by Mr. James B. Kelly, of Canton, Miss. It is an effective fastening both for the blinds and the window, which cannot be tampered with from the outside, and when the blinds are thrown open the device swings with the blinds out of the way, while by it the blinds may be held closed in a convenient manner, both when the window is raised and when closed.

A mouthpiece for speaking tubes has been patented by Mr. Patrick McGunnigle, of New York City. It is composed of two main parts connected together back of the bell by a lap joint, in such way that the shaft and whistle have their axis at the diameter of the mouthpiece, and thus avoid hinges and other details of construction of the ordinary form of mouthpiece.

A machine for sharpening and gumming saws has been patented by Mr. George P. Saltenberer, of Hamburg, Ark. It is for use with gin saws, and has reciprocating files which operate simultaneously and are drawn back out of contact with the saw teeth at the moment when the saws are being turned, the device being readily changed from a saw sharpener to a saw gummer, and being very rapid and efficient in operation.

A wagon brake lever has been patented by Mr. George J. Riblet, Sr., of Shinnston, West Va. A lever is fulcrumed on the brake hand lever, engaging with one end a fixed segment, a spring lever fulcrumed on the brake hand lever, provided with a segmental gear wheel arm, meshing into a segmental gear wheel arm formed on the other lever, making a lock for the lever of a wagon brake in which the lever is firmly held in place when the brakes are applied.

SCIENTIFIC AMERICAN BUILDING EDITION.

DECEMBER NUMBER.

TABLE OF CONTENTS.

The Scientific American Architects and Builders Edition is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming, practically, a large and splendid MAGAZINE OF ARCHITECTURE, richly adorned with elegant plates in colors and with fine engravings, illustrating the most interesting examples of Modern Architectural Construction and allied subjects.

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Special.

A NEW MINISTERIAL EXPERIENCE.

One year ago last December the pastor of a church in Philadelphia was forced to surrender his pulpit, and, acting on his physician's advice, with his young wife sought the warmer climate of Florida. Both were consumptive, and when it became evident that the young minister must relinquish a future that promised so much, he was broken in spirit. Together these two afflicted persons traveled toward the milder latitudes. It seemed a journey to death. Nothing more pathetic has been seen since Charles and Mary Lamb set out hand in hand, and with tearful eyes, toward the madhouse to which they had self-condemned themselves. The parting from their friends and parishioners at the railroad station was affecting in the highest degree. Several long, weary months followed, in which the hoped-for improvement was awaited. It came not. Both man and wife gradually grew weaker. The little cottage they had taken at Jacksonville finally began to lack necessary comforts. A small negro servant had to be discharged because she could no longer be paid. Then the despairing young wife took to her bed, and rapidly grew worse. One good lady assumed that death was inevitable, and hoped only to make the end as painless as possible. In her mission of kindness she encountered a hale old gentleman who, after he had given her a ten dollar note, added: "I will do more. I will send that unfortunate woman my Compound Oxygen. I always take it with me to cure sudden colds or throat affections; but I know what it can do even in desperate cases." In a few minutes he was ready, and accompanied the noble hearted lady to the house of suffering. Hot water was readily procurable, and in a brief time the consumptive was inhaling the Compound Oxyen, evolved from one of Drs. Starkey & Palen's Home Treatments. At the end of a week notable improvement in the woman's condition set in. The end of another week's treatment found her seated in a chair on the porch, and she was soon after able to walk about. Meanwhile full advice had been received from Dr. Starkey as to the Compound Oxygen, two Home Treatments had arrived, and the minister began to give some attention to his own case. Friends gathered around them amid the Land of Oranges, and now they are both in a degree of health that enables the pastor to resume his pulpit and his good wife the care of her own home.

A valuable and interesting pamphlet on the methods of manufacture and of treatment by Compound Oxygen is sent free to all who desire it, by Drs. Starkey & Palen, 1529 Arch Street, Philadelphia.

Special Notice.

The following is a copy of a testimonial received by the Star Machine Co., of Buffalo, N. Y.:

Navy Yard, New York, July 5, 1887.

SIR:—In obedience to your order of the 9th of June (a copy hereunto attached), to make a careful and thorough test of the Star Machine Co.'s Improved Portable Forge, the Board met on June 28 and proceeded to carry out said order.

Forge No. 8, as per circular appended, was the one chosen for trial, it being best suited for purposes under the cognizance of the Bureau of Steam Engineering, for use on board of vessels.

After a fire had been well under way, two pieces of iron, two inches in diameter, were brought to a welding heat in five (5) minutes and a clean, smooth weld made.

The blast is excellent and continuous; the frame of the forge well braced, and set screws are so arranged as to take up the lost motion of the shaft and other parts.

In conclusion, we beg to state that it is the best Portable Forge that has come under our notice, and we therefore recommend it for use in the Naval Service.

Very respectfully.

[Signed] JOHN L. D. BOTHWICK,
Chief Engineer, U. S. N.
J. J. BARRY,
Passed Ass't Engineer, U. S. N.
F. C. BOWERS,
Ass't Engineer, U. S. N.

To Commodore
Bancroft Gherardi, U. S. Navy,
Commanding U. S. Navy Yard,
New York.

A copy of the original report can be seen at our office, Nos. 198 and 200 Terrace, Buffalo, N. Y.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

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The Sturtevant Mill (a rock crusher and pulverizer combined) is specially adapted to grinding phosphate rock, cement, ores, and all kinds of refractory material, and is meeting with ready sale in this country and in Europe. Full information, with circulars, etc., can be had by addressing Sturtevant Mill Co., 89 Mason Building, Boston, Mass.

Engine lathes, chucks, planers, drills, shapers, presses, shears, etc. Machine and blacksmith shop equipment a specialty. Send for special prices and cuts, stating exactly what is required. W. E. Drew, agt., S. C. Forsaith Mch. Co., Manchester, N. H.

Air compressor, rock drills. Jas. Clayton, 43 Dey St., New York.

LINK BELTING (malleable iron, detachable).—Used for transmission of power and in improved appliances for handling any material in bulk or package. Send for catalogue. *Link Belt Machinery Co., Chicago.*

2½ H. P. engine, $75.00. 2 H. P. engine and boiler complete, $125.00. 2 to 50 H. P. engines and boilers a specialty. American Machinery Co., Cleveland, O.

Very thick walrus, hippopotamus, giraffe, elephant, and buffalo leather for polishing metals. Greene, Tweed & Co., 83 Chambers St., New York.

The Milwaukee Cement Co., Milwaukee, Wisconsin, have recently erected a 20" Sturtevant Mill for grinding their cement, which is doing wonderful work. Full information, with circulars, etc., can be had by addressing Sturtevant Mill Co., 89 Mason Building, Boston, Mass.

Woodworking machinery, planers and matchers, moulders, scroll and band saws, tenoners, mortisers, saw, clapboard and shingle mills, saws, belting, shafting, and mill supplies. Send for catalogues and obtain our prices. W. E. Drew, agt., S. C. Forsaith Mch. Co., Manchester, N. H.

Among the fertilizer works using the Sturtevant Mill for pulverizing phosphate rock may be mentioned the Pacific Guano Co., Woods Holl, Mass.; Walton & Whann Co., Wilmington, Del.; Etiwan Phosphate Co., Charleston, S. C.; Bowker Fertiliser Co., Elizabethport, N. J., all of whom are greatly pleased with the work done, and consider it the best and most economical process that can be adopted.

Large and small punch presses and machine tools. S. M. York, Cleveland, O.

Saws—How to straighten and gum all kinds. See p. 381.

Wanted by a Brick Manufacturing Co.—A good draughtsman. Also a first class mechanic as foreman. Address box 87, Lancaster, Pa.

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For combination lathe chucks, with bodies and jaws ground true; two spindle machines, for drilling and reaming centers of shafts 3" and less diameter; taps, dies, thread tools, small bench drills, for amateurs and machinists; and for reliable automatic grain weighers, address the Pratt & Whitney Co., Hartford, Conn., U. S. A.

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The *Railroad Gazette*, handsomely illustrated, published weekly, at 73 Broadway, New York. Specimen copies free. Send for catalogue of railroad books.

The Knowles Steam Pump Works, 113 Federal St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

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Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

Supplement Catalogue.—Persons in pursuit of information of any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

The Holly Manufacturing Co., of Lockport, N. Y., will send their pamphlet, describing water works machinery, and containing reports of tests, on application.

Curtis Pressure Regulator and Steam Trap. See p. 364.

Billings' Patent Breech-loading Single Barrel Shotgun. Billings & Spencer Co., Hartford, Conn.

We are sole manufacturers of the Fibrous Asbestos Removable Pipe and Boiler Coverings. We make pure asbestos goods of all kinds. The Chalmers-Spence Co., 419 and 421 East 8th Street, New York.

Universal & Independent 2 Jaw Chucks for brass work, both box & round body. Cushman Chuck Co., Hartford, Ct.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Friction Clutch Pulleys. D. Frisbie & Co., N.Y. city.

Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N.Y. See illus. adv., p. 28.

NEW BOOKS AND PUBLICATIONS.

A PRACTICAL TREATISE ON ANIMAL AND VEGETABLE FATS AND OILS. By William T. Brannt. Philadelphia: Henry Carey Baird & Co. 244 engravings. 1 vol., 8vo, 739 pages. Price $7.50.

We have here one of the most useful, as well as the most creditable, contributions which have ever been made to the technical literature of this country. Not only is it thorough and complete, but it stands almost entirely alone in English literature. It is the first treatise of the kind in our literature which does anything more than dip here and there into this highly and widely important subject. The want of such a book has been long and severely felt; and this eminent house, which has done so much for the diversified industries of this country, in its publications, has, we venture to say, never done a better service than by the publication of this treatise. The great work of Dr. Karl Schaedler, upon which it is largely based, is well known to technologists and other chemists as the most complete and reliable book on fixed oils, animal, vegetable, and mineral, published in Europe; but Mr. Brannt, the accomplished American editor, has added largely to the work of Dr. Schaedler, especially in the departments of volatile oils and lubricants. The matter of Mr. Brannt has been collected from widely extended sources, and treats very thoroughly those oils which are peculiarly American, whether fixed or volatile, more especially cotton seed, lard, peppermint, sassafras, birch, etc. The title of this volume conveys a fair idea of the contents, but we would advise our readers that the publishers have adopted a system of issuing with each of their new and important publications a circular giving the full table of contents and specimens of the illustrations. Such a circular of this book can be had on application to Messrs. Henry Carey Baird & Co. There is one especial feature in the publications of this house to be highly commended, and it is worthy of imitation by other publishers. We refer to their full tables of contents and to their ample indexes, which render all important subjects in any of their books easy of reference.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) A. L. J. asks: 1. What will take rust from finely polished steel, such as drawing instruments, etc., without scratching them? A. Mix 10 parts of tin putty, 8 of prepared buck's horn, and 25 of alcohol to a paste. Cleanse the article with this, and finally rub with soft blotting paper. 2. What will prevent their rusting? A. You can preserve them by a coat of colorless lacquer. 3. How to clean gun barrels of rust and keep them so? A. The gun can be cleaned by stopping the opening and pouring in mercury, which, on shaking, will clean up the barrel. Then coat with paraffine. 4. A good cement for leather for patching shoes? A. Make a rubber cement. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 158, under "Cements."

(2) W. H. H. asks: 1. Are pumpkins a good milk-producing food for cows, and have pumpkin seed a tendency to dry up milch cows? A. Pumpkins make a rich food for cows, producing good milk, but not so much as with other kinds of food. They have a drying tendency, and should not be made an exclusive diet under any circumstances. Plenty of hay, a little bran or meal, and a little pumpkin is a good receipt for late fall and winter fodder. 2. What is the best plant for stopping the washing of the banks of a stream where the soil is light and sandy? A. Willow, and plenty of it. 3. Is there any good grass for pasture that will thrive on sandy and gravelly bottom land, where native blue grass will burn out in August? A. Try timothy and clover mixed.

(3) J. E. desires a receipt for making a good blue black copying ink. Take of Aleppo galls, bruised, 9 ounces, bruised cloves 2 drachms, cold water 80 ounces, sulphate of iron 3 ounces, sulphuric acid 70 minims, sulphate of indigo, thin paste, 4 drachms. Place the galls with the cloves in a gallon bottle, pour upon them the water and digest, shaking often, for a fortnight. Press and filter through paper into another gallon bottle. Next put in the sulphate of iron, dissolve it, add the acid, and shake briskly. Lastly add the indigo, mix well, and filter again through paper. The ink is to be kept in well corked bottles.

(4) J. A. P.—We are not acquainted with the special variety of cough drops mentioned by you, but we would suggest the following as an excellent article: Tincture of squills 2 ounces, camphorated tincture of opium and tincture of tolu, of each ¼ ounce, wine of ipecac ½ ounce, oil of wintergreen 4 drops, sassafras 3 drops, and of anise seed oil, 2 drops. The above mixture is to be put into 5 pounds of candy which is just ready to take from the fire, and continue the boiling a little longer.

(5) S. O. H. asks whether the killing of alligators is an industry, if the hides are tanned and used to any great extent, and what per cent of so-called alligator hides are genuine. A. It is an irregular occupation of quite a number, in many places along our southern coast, and, although the supply of skins varies much, a great many thousand are tanned every year. Imitation skins are, however, much more numerous, being made largely of sheepskins and limitedly of split cow hides. A great deal of tough paper stock is made in imitation of alligator leather.

(6) T. M. S. asks: 1. What can I put on my watch face to make it luminous, so that the time can be read in the dark? A. Coat it with luminous paint. See the articles on the paint in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 249 and 407. 2. What solution will remove ink stains from carpets and blots from paper? A. Use a solution of oxalic or citric acid, followed in the case of the carpet, with copious washings with cold water. 3. How can I make a good, hard walk at small cost, in the country? A. See the article on "Foot Walk Pavements," in SCIENTIFIC AMERICAN SUPPLEMENT, No. 82.

(7) J. H. D. asks for a receipt to remove paint from a wood carving without damaging the wood, as burning or scraping would ruin it. A. Mix 1 part by weight of pearlash with 3 parts quick stone lime by slaking the lime in water and then adding the pearlash, making the mixture about the consistence of paint. Lay the above over the whole of the work required to be cleaned, with an old brush; let it remain 14 or 16 hours, when the paint can easily be scraped off.

(8) E. P. M. asks: What amount of oxygen, hydrogen, and carbon is there in steel? A. Steel contains no oxygen, save in the rust there may be upon the outside, and only a possibility of a minute portion of hydrogen. The elements of steel vary much to meet its special qualities. It contains carbon to the amount of from 0·1 of 1 per cent in soft or Bessemer to 2 per cent in high grade steels. In addition to the variations in carbon, it may have silicon and sulphur to the extent of one-tenth of 1 per cent, also phosphorus five one-hundredths of 1 per cent. A grade called manganese steel may have about 1¼ per cent of manganese. All iron and steel is subject to rust from exposure to snow and rain, unless especially protected.

(9) W. C. P. asks: 1. Does paint or black japan injure the sound of a whistle or gong? A. It would probably change the tone. 2. What can I use to thoroughly remove paint or black japan on a whistle or gong which cannot be taken down, and can only be reached by means of a ladder? A. If you can get at the whistle to clean it, you certainly can take off the bell by unscrewing the nut on top, which will enable you also to unscrew the bell from the stud. Boil the bell in caustic soda or potash, which will disintegrate the varnish and allow it to be rubbed off.

(10) R. R. W. writes: I wish to move a large building over ice which freezes from 2 to 3½ feet. Will it be safe? A. Ice 8 inches thick will support heavy wagons and artillery. The crushing strength of ice varies from 327 to 1,000 pounds per square inch. At the lowest figures this is 23 tons to a square foot. This does not represent the bearing power of the ice covering water, in which case it becomes elastic under pressure, and may give way without crushing. A building of moderate weight may readily be moved over ice 3 feet thick, if properly set on runners of large bearing, and moved along at a fair pace. The only difficulty in such work arises from suspension of the work, when the weight might press the ice down in the vicinity of the building, and cause cracks which would flood the depressed surface, and possibly cause disaster.

(11) H. R. E. writes: I have a fine Arkansas oil stone which refuses to work properly after several years of constant use. My tools slide over it without being sharpened. How can I make it cut? A. Soak the stone in turpentine or naphtha for a few days, when it will cut as new.

(12) C. H. S. asks (1) how to make a strong joint with glue. A. Use new glue, and in applying first fill the pores of the wood with thin glue and let it dry; then clean off, and glue it at the joint with strong glue. 2. How to make a good hard oil finish. A. Take of linseed oil 1 pint, rectified spirits 4 ounces, oil of turpentine ½ pint, powdered resin 1½ ounces, rose pink ½ ounce; mix. 3. A good cheap wood filler? A. Boiled linseed oil 1 quart, turpentine 3 quarts, corn starch 5 pounds, japan 1 quart, calcined magnesia 2 ounces; mix thoroughly. You can buy better prepared fillers than you can make.

(13) C. A. D., Virginius, Col., writes: I would like to know the relative speed of an air compressor in high and low altitudes. Take, for example, a Rand drill compressor, running at the rate of 30 revolutions per minute at sea level. Would it have to run faster at this altitude, it being 12,600 feet above sea level? A. At above elevation the atmosphere is but two-thirds the density of the air at the sea level. Pumps should run at a speed of 45 revolutions per m. for the volume of compressed air as computed for the sea level.

(14) G. H. W. asks in what way he can make a battery to run a single bell 2½ inches diameter, by using a cast iron box 5½ inches wide, 8½ inches deep, and 17½ inches long. A. Place a layer of black oxide of copper at the bottom of the iron vessel, fill with strong caustic potash solution, and suspend in it horizontally a good sized zinc, preferably a thick plate 4 inches by 14 inches or thereabouts in size. Connect one wire to the zinc, the other to the iron.

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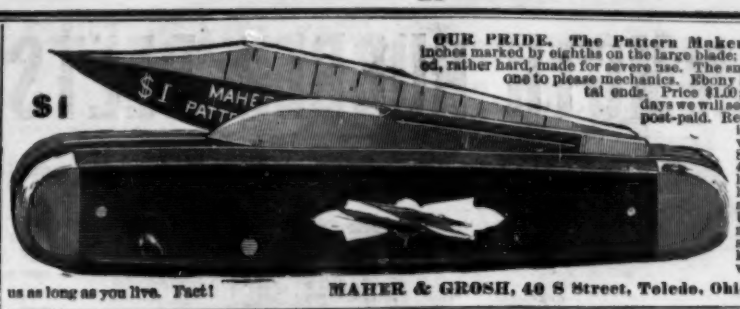

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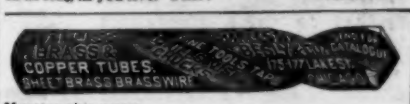

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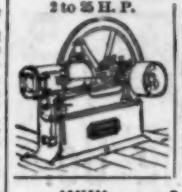

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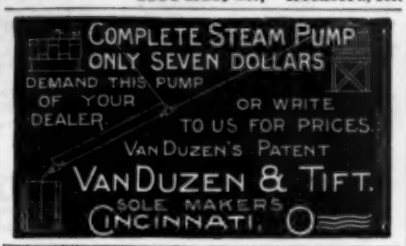

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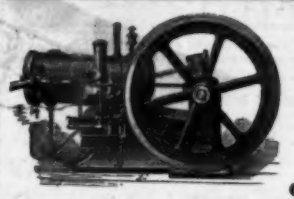

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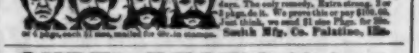

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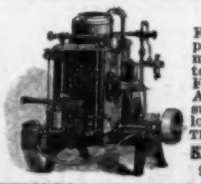

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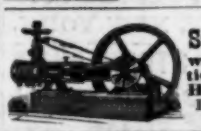

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Proposals for Tools for the Navy Yard, Brooklyn, New York.—NAVY DEPARTMENT, WASHINGTON, D. C., *November* 25, 1887.—Sealed proposals will be received at this Department until 12 o'clock noon, on Monday, the sixteenth day of January, 1888, at which time and place they will be opened in the presence of attending bidders, for furnishing tools and materials required by the Bureau of Construction and Repair, and for the delivery of the same at the Navy Yard, Brooklyn, New York. Printed schedules particularly describing the tools, blank forms on which proposals must be made, and all other information essential to bidders can be obtained by regular dealers in, or manufacturers of, the articles required, on application to the Commandant of said Navy Yard. Proposals must be made in duplicate, and enclosed in sealed envelopes marked "Proposals for Tools for the Navy Yard, Brooklyn, New York," and addressed to the Secretary of the Navy, Navy Department, Washington, D. C. All bids must be accompanied by either plans or descriptive cuts of the principal tools which the dealer offers to furnish. The Secretary of the Navy reserves the right to reject any or all bids, in whole or in part, as, in his judgment, the interests of the Government may require.
D. B. HARMONY, *Acting Secretary of the Navy.*

Proposals for Machine Tools for the Ordnance Gun-Shops.—NAVY DEPARTMENT, WASHINGTON, D. C., *November* 2, 1887.—Sealed proposals will be received at this Department, until 12 o'clock noon, on Thursday, the 5th day of January, 1888, at which time and place they will be opened in the presence of bidders, for furnishing the necessary material and labor and constructing eleven (11) 6-inch gun lathes and one (1) slotter, and for the delivery and erection of the same in the Navy Yard, Washington, D. C., in accordance with plans and specifications, copies of which, together with all other information essential to bidders, may be obtained at the Bureau of Ordnance, in this Department. Proposals must be made in duplicate, in accordance with forms which will be furnished on application to the Bureau of Ordnance, and enclosed in envelopes marked "Proposals for 6-inch Gun Lathes and Slotter," and addressed to the Secretary of the Navy, Navy Department, Washington, D. C. The Secretary of the Navy reserves the right to reject any or all bids, as, in his judgment, the interests of the Government may require.
D. B. HARMONY, *Acting Secretary of the Navy.*

Proposals for Machine Tools for the Ordnance Gun-Shops.—NAVY DEPARTMENT, WASHINGTON, D. C., *November* 2, 1887.—Sealed proposals will be received at this Department, until 12 o'clock noon, on Thursday, the 1st day of March, 1888, at which time and place they will be opened in the presence of bidders, for furnishing the necessary material and labor and constructing sixteen (16) 16-inch gun lathes, and for the delivery and erection of the same in the Navy Yard, Washington, D. C., in accordance with plans and specifications, copies of which, together with all other information essential to bidders, may be obtained at the Bureau of Ordnance in this Department. Proposals must be made in duplicate, in accordance with forms which will be furnished on application to the Bureau of Ordnance, and enclosed in envelopes marked "Proposals for 16-inch Gun Lathes," and addressed to the Secretary of the Navy, Navy Department, Washington, D. C. The Secretary of the Navy reserves the right to reject any or all bids, as, in his judgment, the interests of the Government may require.
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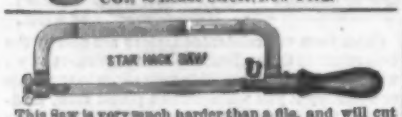

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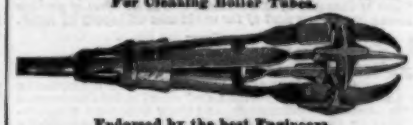

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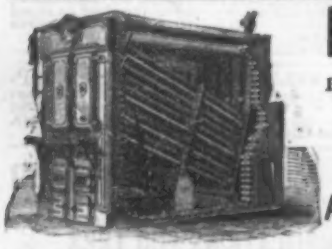

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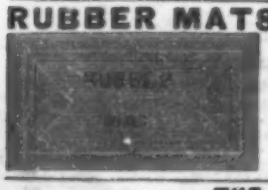

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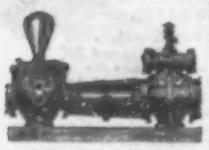

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